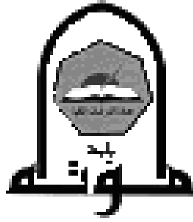


Mu'tah University
Deanship of the Graduate Studies

Sustainable Value Perspective through Value Engineering Concept and Management: Jordanian Industry Sector as a Case Study

By

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A Thesis Submitted to the Deanship of the Graduate Studies in Partial Fulfillment of the Requirement for the Degree of Master of Engineering Management (MEM) Department of Industrial Systems Engineering

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Dedication

I dedicate this work to those who grant me unconditional love and support. To my dear **parents**, **brothers**, **sisters** and to my dear **wife** for her patience, enthusiasm, vast knowledge that helped me in my study and for her continues support in my life. I could not have imagined having a better friend like you my dear wife.

Mohamd Omar Al-Laimon

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I would like to express my sincere gratitude to my advisor Prof. Dr. Salloom A. Al-Jibury for the continuous support and guidance in my study, which helped me in all the time of research and writing of this study. Besides my advisor, I would like to thank the members of the examination committee. Thanks also goes to the lecturers of the department of Industrial Systems Engineering and other departments who have a great role in our education and support.

Mohamd Omar Al-Laimon

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List of Abbreviations

VE	Value Engineering
VM	Value Management
SV	Sustainable Value
APC	Arab Potash Company
JPMC	Jordan Phosphate Mines Company
GDP	Gross Domestic Product
FAST	Function Analysis System Technique
SAVE	Society of American Value Engineers
IEC	International Executive Council
IVM	Institute of Value Management
GCC	Gulf Cooperation Council
PH	Phosphate
ASS. CO.	Associates Companies
SOW	Scope of Work

Abstract

Sustainable Value Perspective through Value Engineering Concept and Management: Jordanian Industry Sector as a Case Study

Mohamd Omar Al-Laimon

Mu'tah University, 2013

The aim of this study is to assess the awareness of value engineering and to investigate value engineering (VE) practice in Jordan Phosphate Mines Company and Arab Potash Company as cases of study, and the importance of the use and adoption of value engineering to achieve sustainable value in the Jordanian industry sector to reach sustainable industry. A survey methodology was utilized using questionnaires to gather data from a list of the two companies (JPMC and APC) from Jordanian industry sector. A total of 67 usable questionnaires were received and were used for data analysis from 100 managers and engineers representing the research sample. Descriptive analyses were used to achieve the study objectives.

The findings indicate that, very few of respondents know the essence of value engineering and there is no actual usage in their organizations, and a high percentage of the respondents have a desire to learn more about value engineering. Although the concept of sustainability is well understood within the most of the respondents, but most of them are not involved in the strategic plans for sustainable value creation in the company, and company procedure towards sustainable value creation is not enough until now and suffers from a lack of transparency and a lack of familiarity or involvement of the workforce in the strategic plans of creating sustainable value in the company.

The study concludes with several recommendations for the decision makers in Jordanian Industry sector and researchers, in addition to tips to study other variables related to value engineering that is hoped to move the field forward.

Keywords: Value engineering, Awareness, Practice, Sustainable value, Jordanian industry sector.

الملخص

منظور القيمة المستدامة من خلال مفهوم هندسة القيمة والادارة: دراسة حالة في القطاع الصناعي الاردني

محمد عمر الليمون

جامعة مؤتة، 2013

الهدف من هذا البحث هو تقييم وضع هندسة القيمة وعياً وممارسةً في شركة مناجم الفوسفات الاردنية وشركة البوتاس العربية واهمية استخدام وتبني هندسة القيمة لتحقيق القيمة المستدامة في القطاع الصناعي الاردني للوصول الى صناعه مستدامة. تم استخدام المنهج المسحي باستخدام استبانة لجمع البيانات من قائمة تضم شركتين (شركة مناجم الفوسفات الاردنية وشركة البوتاس العربية) من القطاع الصناعي الاردني، حيث تم اعتماد 67 استبانة لغاية تحليل البيانات من 100 من المدراء والمهندسين يمثلون عينة البحث. وقد تم استخدام التحليل الوصفي لتحقيق اهداف البحث.

خلصت الدراسة الى ان القليل جداً من المشاركين يعرفون جوهر هندسة القيمة ولا يوجد تطبيق فعلي لها في منظماتهم الا ان نسبة عالية من المشاركين ابدوا رغبتهم في معرفة المزيد عن هندسة القيمة وخلصت الدراسة ايضاً الى انه بالرغم من فهم المشاركين لمفهوم "الاستدامة" الا ان معظمهم لا يتم اشراكه في وضع الخطط الاستراتيجية لخلق القيمة المستدامة في الشركة وان توجه الشركة نحو عملية خلق القيمة المستدامة لا يزال غير كافي ويعاني من نقص في الشفافية وقلة اشراك القوى العاملة في وضع الخطط الاستراتيجية لخلق القيمة.

وقدمت الدراسة عدة توصيات لصناع القرار في القطاع الصناعي الاردني والباحثين بالاضافة الى نصائح لدراسة متغيرات اخرى تتعلق بهندسة القيمة يؤمل منها أن تطور البحث العلمي في هذا المجال.

الكلمات الدالة: هندسة القيمة، الوعي، الممارسة، القيمة المستدامة، القطاع الصناعي الاردني.

Chapter One
Introduction

1.1 Overview

It is important to realize the key to long-term success in any industry is to produce products or services that provide good value and achieve customer satisfaction. This success relies on the use of an effective tool that can be used in product development and design which helps the organization to compete with other organizations. This effective tool is value engineering.

Value engineering (VE) is a management tool to achieve the essential functions of a product, service, or project with the lowest cost. Surprisingly, little research has been done on how to re-utilize the ideas and solutions generated in previous VE studies for future projects.

“Value engineering is an organized application that uses a combination of common sense and technical knowledge to locate and eliminate unnecessary project costs. Applying sound VE principles can effectively reduce costs and thus enhance project value” (Mahdavi *et al*., 2011, pg. 183).

“Value engineering is a systemized approach to seek out the best functional balance among the long-term cost, reliability, and performance of a project. It is important to note that it is not, as many people believe, strictly an exercise in cost cutting” (Pylkas *et al*., 2002, pg. CS. 161).

“The term value management (VM) encompasses both value engineering and value Analysis. In fact, to some, the three phrases are interchangeable and generalized as the “value methodology” (Fletcher *et al*., 2004, pg. 553).

Sustainable development is an important requirement for long-term value creation and future financial returns. Value creation is sustainable when managing the balance between society, environment and economy. Sustainability from business management perspective: “Sustainability is the way an organization creates value throughout the entire closed-loop lifecycle of a product or service by maximizing and balancing the positive social, environmental and economic effects of its activities while minimizing their adverse impacts” (Borges, 2012, pg. 1).

When any organization embraces sustainability, it begins achieving its prime directive of finance by collating the essential business-based concept of green efficiency into all of its basic management policies, strategies, tactics, procedures and activities. Here's the green efficiency mandate: “Achieve the organization's people, planet and profit objectives with least cost, effort and risk throughout the entire closed-loop lifecycles of its services and products” (Borges, 2012, pg. 3).

Through the above definitions we recognize that VE is: A powerful tool that is used to identify problems and develop proposed solutions by determines the best design alternatives projects, processes, products or services. It is used to reduce unnecessary cost, improve quality, increase reliability, availability, and customer satisfaction. In other meaning it is used to improve organizational performance. It represents the industrial engineering techniques and the structure of operations management.

The usefulness and importance of the adoption of a value engineering methodology can be clearly seen through the following facts:

1- In 1996 president Clinton signed into law an act obliging all executive agencies to establish value engineering procedure – the estimated savings for 1996 alone were for cast at $2.19B (Elias, 1998).
2- Value studies are mandatory in: All US federal projects > $2M; all Japan projects > $2M; all Saudi government projects > $5M; all RC of J and y projects > $5M; all Saudi Aramco projects > $10M; also in UK, Germany, France, Australia, Korea, India, Malaysia… etc. (Al-Yousefi, 2010).
3- VE studies done since the start of VE in the GCC in 1978: more than 3000 VE studies; more than 35000 participants, done at the rate of 80-100/year; improved the quality of GCC projects; saved more than $10 B; saving range from 5-30%; rate of return is 1:100 (Al-Yousefi, 2010).

The purpose of this study is to report on an empirical study of the awareness and practice of value engineering by Jordan Phosphate Mines Company (JPMC) and Arab Potash Company (APC) as case studies. And to show the unique combination of concepts and methods that is used by VE to create and manage sustainable value for both organizations and their stakeholders. Also this research has provided a useful knowledge on the perceptible impact of value engineering through organizations that adopted VE philosophy.

1.2 Statement of the Problem

Undoubtedly the biggest challenges faced the Hashemite Kingdom of Jordan recently is the economic challenge, and this challenge as a result of many things accumulated until reached to this bad situation. One of the most important of these things is the failure to implement proven global programs in countries that have adopted such programs. This backwardness and lack of application has led to direct negative impact on government and private institutions alike, which caused the greatest impact on increasing the waste of state resources and increase their suffering. These programs, which are an integral part of the administrative process and productivity in the industrial

sector and dealing with quality control, and value improvement. Surprisingly, little research has been done in Jordan focused on value engineering study, which is one of the most important tools and programs in the administrative process and productivity that achieve financial savings without affecting the value and quality. Therefore this study will examine the awareness and practice of value engineering in Jordan Phosphate Mines Company and Arab Potash Company, and its integration with sustainability and will not overlook prove the impact of this powerful tool in the success and provide solutions of many projects in a lot of organizations that have adopted the application of this tool. The problem of this study can be summarized by answering the following questions:

1- What is the level of awareness and practice of value engineering in the targeted organizations?
2- What is the level of awareness in "the culture of sustainability" and its implementation in the targeted organizations?
3- Why through using value engineering we can achieve sustainable value, green efficiency and green management?

1.3 Objectives of the Study

The purpose of this study is to:

1. Assess the awareness of value engineering and to investigate value engineering (VE) practice in Jordan Phosphate Mines Company and Arab Potash Company as cases of study.
2. Measure the willingness to learn more about value engineering.
3. Investigate the sustainable value principles and its implementation in the companies selected by the current study.

A primary aim is to convince the decision makers of the importance of the adoption of value engineering through:

1- Highlight value engineering approach by introducing the experiences of developed countries in this area.
2- Present successful experiences.
3- Evaluate the impact of value engineering on technical and economic returns of the organization.

1.4 Importance of the Study

The importance of the study and its contribution to the literature:

1- It's one of the few studies in Jordan, which discussed value engineering in general.
2- It's one of the rare studies that examined the role of value engineering in Jordanian industry sector.

3- It's one of the rare studies that discussed sustainable value perspective through value engineering concept.
4- The study is going to use the most important dimensions of value engineering (awareness and practice) and its integration with sustainable value.
5- Through this study, decision-makers will be aware of the importance of value engineering and the importance of transfer and indigenization its philosophy.
6- It will also serve as basis in the study of other variables affect the different sectors in Jordan.
7- The results of this study will provide some insights and information on how to take advantage of value engineering to repair the deteriorating economic situation in Jordan.

1.5 Jordanian Industry Sector

A recent Global Competitiveness Report for the year 2010-2011, that is issued by (World Economic Forum) on an annual basis since 1979, Who is studying competitive economies of the participating countries in the report and arranged it in accordance with the indicators and determinants of the competitiveness of the economy and the business environment compared to the performance of the participating countries. The report included (139) country, Jordan came in ranked (65), retreating (15) arranged for last year. The industrial sector is one of the largest economic sectors in terms of the percentage of its contribution to the gross domestic product (GDP), which amounted to 26.2% for the year 2009. The industrial sector is one of the most interconnected sectors to other sectors which give it great importance, in any economy. The percentage operation of the industrial sector in Jordan is about 12.8% of the total number of employees for the year 2009 and the number of its companies recorded 1438 and estimated the total share capital, including a 153.1 million J.D. The total exports of the industrial sector 3034 million J.D. in 2009 representing 84.85% of the total National exports (Jordan Chamber of Industry, 2010).

The industrial sector is a strategic sector raises competitiveness and contributes significantly in the Jordanian economy as a whole.

This study is interested in Jordan Phosphate Mines Company and Arab Potash Company, Because of its extreme importance for Jordan, which is one of the most important mining industries in Jordan.

1.6 Organization of the Study

The study is structured as follows: The next chapter reviews the relevant literature and presents previous studies. Chapter three describes the research method, sample, survey procedure and operational definitions. Finally, chapter four presents statistical analysis, discussion of the results, conclusion, recommendations and limitations of the study.

Chapter Two
Literature Review

This chapter provides an overview of value engineering in general and its relationship with other management approaches and presents concepts of the sustainability, green efficiency and green management through using value engineering. Also reviews relevant prior studies.

2.1 Value Engineering (VE)

'Value Engineering is not simply about money…it's about value' (Kirk *et al.*, 2002).

As previously mentioned, value engineering is an organized, function based approach to the identification and elimination of unnecessary cost. It is a systematic problem solving process with a multi-discipline team approach. Value engineering is a proven management technique free of normal design restrictions. It is value oriented, such that it uses function based analysis, such as F.A.S.T. (Function Analysis System Technique) to optimize designs or processes (Alwerfalli *et al.*, 2010).

2.2 History and Development

The value analysis concept was conceived by Mr. Lawrence D. Miles during the 1940s. He worked for General Electric, a major defense contractor, which faced the scarcity of strategic materials needed to produce their products during World War II. Miles realized that if value and related innovation improvements could be systematically "managed," then General Electric would have a competitive advantage in the marketplace. With that ambition in mind, Miles took the challenge and devised the function analysis concept, and integrated it into an innovative process that became known as value analysis. Miles understood that products are purchased for what they can do. These products can either do work or provide pleasing aesthetic qualities (Society of American Value Engineers (SAVE) International, 2005).

In 1954, the U.S. navy bureau of ship building became the first federal agency to use this technique. By 1961 VE was formally used throughout the Defense Department. Other federal agencies, such as the Department of the Interior, the postal service, the Veterans Administration and NASA were quick to follow. Although VE was used first on manufactured products, people soon realized that this methodology was just as applicable to the design and service process as it was to manufactured products. The Department of Defense was the first to establish a formal program to subject their design and construction projects to VE. In the early days, this technique was called value

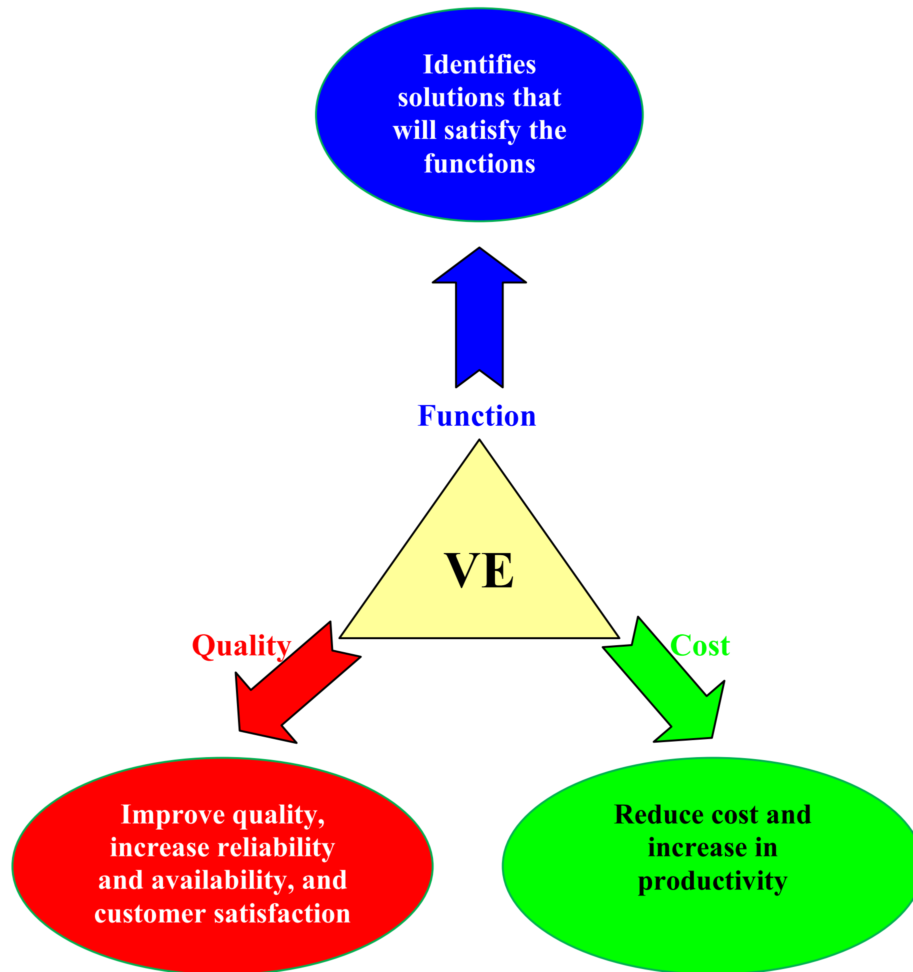
analysis. Later on other names such as value management, value improvement, value control and value buying were used. The U.S. Navy changed the name to “Value Engineering” to emphasize the engineering aspect of the methodology. This name “Value Engineering” is the one most widely used. Notwithstanding the change in the name, the objective of value engineering remains the same, that is, “to provide a means of total cost control anywhere during the product/service life cycle, without sacrificing the quality or the reliability of the product or service” (Elias, 1998).VE spread out from the USA to North and South America, Europe, Australia, Asia, the Middle East, and parts of Africa. The international growth caused the membership of Society of American Value Engineers (SAVE), to reconsider the society’s name and was changed to “SAVE International” in 1996 (Al-Yousefi, 2009).

2.3 Value Engineering Concept

Value Engineering (VE) is an intensive, interdisciplinary problem solving activity that focuses on improving the value of the functions that are required to accomplish the goal or objective of any product, process, service, project or organization (International Executive Council, 2012).

According to Al-Yousefi (2009), value engineering concentrates on the effectiveness through stating functions, goals, objectives, needs, requirement and desires. Then determine the quality features that make the product more acceptable. Finally, generate VE Proposals that meet the requirements at the least possible Life Cycle Cost. Therefore, according to Al-Yousefi (2004, pg. 3), VE can be defined as: “An organized team effort aimed at analyzing functions and quality of projects in order to generate practical cost-effective alternatives that meet customer requirements”.

VE is a balance between Function, Quality and Cost as shown in figure (2.1).



Source: by the author

Figure (2.1)
Value engineering main issues

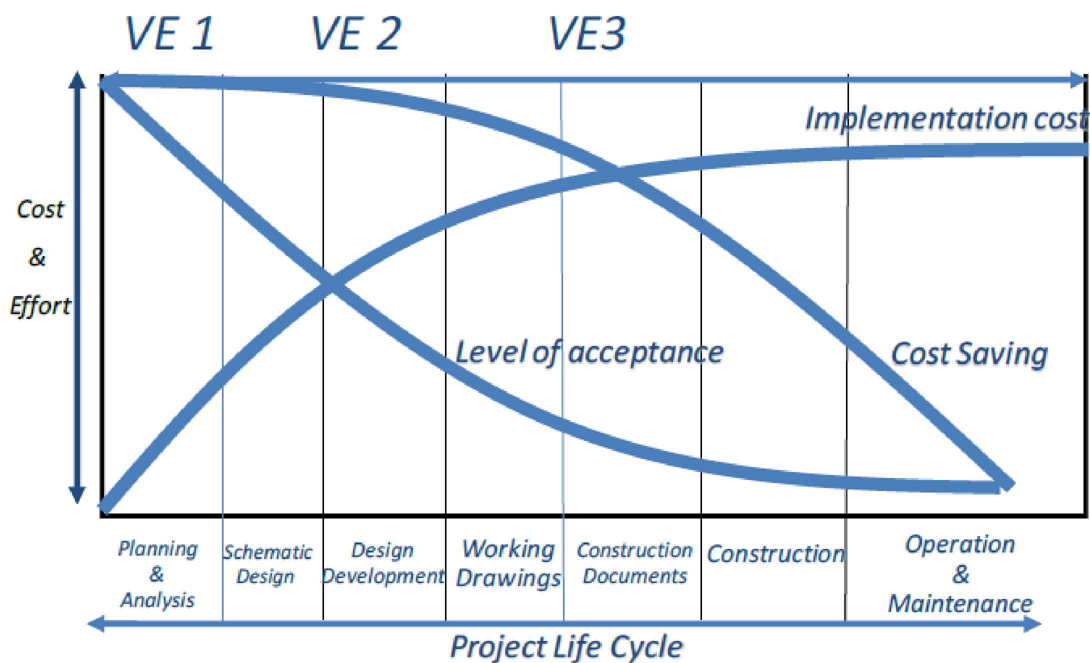
2.4 Value Engineering Applicability

In general the earlier the VE process is applied the more effective it is likely to be. VE can be applied at any time or stage during the life of a project. Lane, *et al*., (2004) indicates that the greatest impact of value engineering when it is conducted at the appropriate stages of the project. The proper time to apply value engineering according to him is controlled by:

1- Obtaining maximum value from the VE effort.
2- The case or difficulty, with which value engineering may be applied. Greater savings normally result if value engineering is applied early in the design phase.

According to Al-Yousefi (2009), the greatest benefit and resource savings are typically achieved early in the development and conceptual design stages. VE may be applied more than once during the life of the project. Also he indicates that the potential savings from VE and the ideal way is to apply VE at three deferent design stages, as shown in figure (2.2).

1- The first VE study (VE1): is applied during the design planning stage to define project functions, goals, objectives, requirements, design criteria and scope of work (SOW).
2- The second VE study (VE2): is applied at about 15-30% of design, to generate detailed VE proposals and alternatives to the design and to define technical systems and make sure that value engineering proposals (VEP) of VE1 are implemented.
3- The third VE study (VE3): is a mix of VE and design review (DR) and its is applied at about 80-85% of design to check the conformance to codes, standards, specifications and make sure that VEP of VE2 are implemented.



Source: by (Al-Yousefi, 2009)

Figure (2.2)
Potential savings from VE

The current study indicates that when analyzing the curve several considerations must be taken into account:

1- First, the willingness to change depends on the level of acceptance, which gets less as cost of saving becomes less.
2- Second, there is a point beyond it the cost of implementation becomes higher than the cost of saving, which means a net loss, as shown in figure (2.2).

2.5 Value Methodology

According to International Executive Council (IEC) meeting (2012), the value methodology is a systematic and structured approach, improves projects, products, and processes. Value methodology is used to analyze manufacturing products and processes, design and construction projects, and business and administrative processes. Also IEC indicates that value methodology helps Achieving a balance between the required functions, performance, quality, safety, and scope on the one hand and cost and other resources needed to accomplish these requirements on the other hand. The proper balance to find the maximum value in the project (IEC, 2012).

Value = Function/Cost

1- Value is the reliable performance of functions to meet customer needs at the lowest overall cost.
2- Function is the natural or characteristic action performed by a product or service.
3- Cost is the expenditure necessary to produce a project, service, process, or structure.

2.6 The VE Job Plan

Al-Yousefi (2009) refers to SAVE International Standard VE Job Plan, shown in figure (2.3), to illustrate that value engineering is applied through a process called "Value Engineering Job Plan". The plan contains of the following seven successive phases:

Information Phase

It is the first task for the value engineering team, during this phase value engineering team will collect, organize, and analyze information to understand the requirements of the project, product, process or system.

Function Analysis Phase

This phase is the cornerstone of value engineering, every aspect of the project is described through a decision logic diagram. This combination helps identify the basic needs involved in the project.

Creativity Phase

Use brainstorming to generate ideas aimed to find alternatives that satisfy the best value. At this stage the focus is on the quantity of ideas not the quality of ideas. No critical judgments or comments are allowed during this phase that might inhibit creative thought.

Evaluation Phase

The ideas generated in the creativity phase are evaluated. Those ideas are assessed in terms of the greatest probability for implementation. Each idea is examined as to cost, feasibility, and value obtained. Also tested against the criteria and limitations besides the economic analysis, life-cycle cost analysis, tradeoff analysis and sensitivity analysis. In addition to safety, reliability, environmental impact, aesthetics, maintainability and look at non-economic issues.

Development Phase

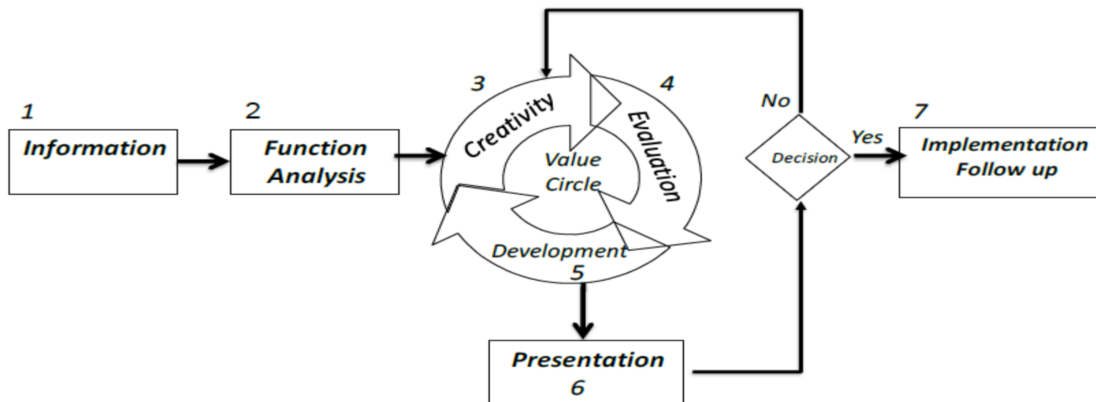
Developed the option selected in the evaluation phase into workable value engineering recommendations. The recommendations provide enough information to make the decision such as the cost of implementing the recommendations, advantages and disadvantages of recommendations implementing, and supporting data such as calculations, sketches, life cycle cost comparison, and product information sheets.

Presentation Phase

The purpose of this phase is to convince the decision makers of the recommended option, also clarifies any misunderstandings between project requirements and the value engineering recommendations.

Implementation Phase

Get the management approval for go ahead and make follow up to ensure the recommendation is properly developed by the engineer.



Source: by (Al-Yousefi, 2009)

Figure (2.3)
The seven phases of the VE job plan

2.7 Value Engineering Strengths & Weaknesses

According to AUTUMNWOOD Services Inc. (2012) (http://autumnwood.wordpress.com), there are points of strength and weakness in value engineering as follows:

Strengths

1- VE relies on a rigorous interdisciplinary approach to problem solving.
2- VE uses a systems approach to problem identification and solution.
3- VE is function oriented and promotes a "clean-sheet" approach that supports innovative solutions.
4- Creativity is a key component to the VE problem solving activities that promotes "breakthrough thinking."
5- VE uses a structured "job plan" that promotes consistency in application and helps assure results.
6- Increased competitive advantage comes from the identification of innovative ways to accomplish key functions at a lower cost with improved quality and reliability.

Weaknesses

1- Successful VE results are dependent on the quality of information brought to the VE workshop for evaluation.
2- Many times, VE is used too late in the product development cycle to impact the design, and when changes would be too costly to implement.
3- There are many misunderstandings and biases against VE that have been built up over time due to misuse of the methodology:
    1- It cheapens the product without improving it.
    2- I'm an engineer. We do VE all the time.
    3- VE is only used for cost reduction.

2.8 Value Methodology versus other Business Processes

Fletcher *et al*., (2004) indicates that since the emergence of value methodology, several other management or business processes approaches have appeared on the square business: total quality management, quality function deployment, project management, concurrent engineering, reengineering, benchmarking. The value methodology is open for use with other approaches, and its combined strengths customer needs, teamwork, function analysis, creativity and a rigorous system approach – rise above the strengths of other processes.

2.9 Value Engineering Effectiveness

According to Fletcher *et al*., (2004), the effectiveness of value engineering answers the question of "why use value engineering". He cited the following list of reasons:

1- To achieve best value, i.e. to balance worth (function, benefit, performance quality) and cost.
2- To save money. Value engineering has been proven to retain essential functions while reducing overall cost.
3- To develop consensus among stakeholders.
4- To benefit from a return of investment (ROI) of 10:1 or greater.
5- To increase profitability.
6- To obtain new ideas from a fresh perspective to improve quality.
7- To combine ideas of owner, designer and VE team to improve quality.
8- For quality assurance.
9- For strategic planning.
10- To make complex decisions or solve difficult design problems.
11- For concept development.
12- To get a project or product back within budget constraints.
13- To minimize annual costs and/or other life cycle costs.
14- To meet regulations requiring VE.
15- To reduce risk, improve schedule, or obtain other project benefits.

2.10 Sustainability and Value Engineering

There is no doubt that interest in sustainability issues is increasing day after day at the global level for its contribution in creating and improving value. The Institute of Value Management (IVM), (2002) states that the concept of value relies on the relationship between the satisfaction of many different needs and the resources used in doing so. Different needs include many aspects, such as high quality, reliability and availability, customer satisfaction, good indoor and outdoor environment, reducing consumption,

durability, proper price, reduce cost and increase in productivity ... etc. all these needs are part of sustainability objectives. This means that any value enhancement technique integrates with sustainability issues and creates additional and sustainable value. Value engineering is this technique that we're talking about it currently. In this section, this study will discuss this subject through the following:

1- Findings from literature on the importance of value engineering/value management as a means to achieve sustainable value.
2- Findings from two cases study to investigate the existing practices of VE in its attitude to sustainability.

Sustainability concerns protecting environmental quality, enhancing social prosperity and improving economic performance (Addis and Talbot, 2001). There are many studies on the subject of sustainability and value management. But studies that highlighted the contribution of VE towards sustainability are few (by the extensive research of the current study). According to Zainul Abidin and Pasquire (2005), several papers have been presented at conferences held by IVM Australia in 2002 and Hong Kong in 1999 that relate value management with sustainability. These papers discussed the following:

1- Importance of sustainability in improving value (Barton 2002; Barton et al., 2000; Schneider, 1999).
2- The potential of value management to promote sustainability (Yeomans, 2002; Barton et al., 1999; Phillips, 1999).

Integration between sustainability and value management would enhance the reputation of value management (Fong, 2003; Schneider 1999).

According to Borges (2012), much of the discussion revolved around the sustainable value and what should industry do to achieve social and environmental responsibility? And what motivates companies to adopt enthusiastically the idea of sustainable value? This study provides insight for achieving sustainable value through value engineering, and the possibility of increasing profits by achieving and adopting the concept of sustainable value, and refute some doubts which are based on the motives of companies that allege profits and reduce costs is the main objective of the manufacturing process.

2.10.1 Corporate Environmental Sustainability

As mentioned earlier Borges (2012) defines the corporate environmental sustainability from business management perspective as follows: "Sustainability is the way an organization creates value throughout the entire closed-loop lifecycle of a product or service by maximizing and balancing the

positive social, environmental and economic effects of its activities while minimizing their adverse impacts".

This definition according to him involves the following five functions of corporate environmental sustainability:

1- Systematically managing all aspects of a sustainability program within an organization's resource limits and opportunities.
2- Avoiding and controlling risks, including – but not limited to – environmental, health and safety regulatory compliance, as well as compliance with an ever-expanding myriad of industry-specific standards.
3- Reducing costs by eliminating all kinds of waste, including administrative, operational and environmental wastes.
4- Growing revenues with green-attribute products and services, and
5- Leveraging competitive advantages through green wash-free organizational transparency.

Also he indicates that as a result of adopting sustainability, organization begins achieving its prime directive of finance by applying the concept of **Green Efficiency** into all of its basic management policies, strategies, tactics, procedures and activities. Upon his view. Green efficiency mandate:
"Achieve the organization's people, planet and profit objectives with least cost, effort and risk throughout the entire closed-loop lifecycles of its services and products".

2.10.2 Green Management Perspective through Value Engineering

Through value engineering concept and definition, we can answer the following question: why this concept? Because through value engineering a company manages and reduces risks, achieves best value and reduces costs, increases profitability and other competitive advantages.

According to Borges (2012), the basic idea of value engineering is:
"Get the junk out of corporate activities because for every dollar put into production and/or service delivery, the organization should have more product and/or service capacity to sell by eliminating waste!". So through this idea, every activity in a value system in the organization represents a significant risk to the value to be achieved. The junk that reduces or prevents the value gains includes:

1- Delays.
2- Mistakes.
3- Defects.
4- Waste, of all kinds.

5- Work-around and rework, which are two rather insidious forms of wasted labor effort and other production resources.
6- Accidents, and Negligence.

Borges (2012) stated that when the company gets rid of unwanted and inefficient junk from its various activities, and focuses on policies that are very important in sustainable value creation and business conduct, the company will be able to not only achieve financial goals, but to achieve environmental and social goals alike.

2.11 Integrating Sustainability within Value Engineering

According to Zainul Abidin and Pasquire (2005), Committing to sustainability during value management could lead to generating good economic return with delivering accountability and excellence in our social and environmental performance and sustainability should not be seen as an "add on" to value management requirements but truly integrated into all facets of planning and design, the sustainability knowledge can be applied through value engineering job plan when defining functions, generating ideas during creativity phases and developing proposals to the decision makers, highlighting the estimated cost savings and the features that protect the environmental and social interest and provide long-term economic return. The ideality of VM to improve sustainability is discussed from two perspectives:

1- The strengths of VE for sustainability.
2- The relationship of VE with sustainability.

2.11.1 The Strengths of VE for Sustainability

The strategic timing of VM creates an opportunity to include sustainability early in the project where its impact will be greatest (Zainul Abidin and Pasquire, 2003). The VM process is systematic as it uses a structured job plan that guides the team through problem seeking and solving in a co-ordinated manner (Woodhead and Downs, 2001). Phillips (1999) indicated that VM process can be adapted and applied to align stakeholder views and to develop jointly acceptable strategies for moving towards agreed, long term, sustainable solutions. Through its tools and techniques, VM offers a means for the client to contribute to a better built environment and the opportunity to stimulate improvements in the construction process (Hayles, 2004). Zainul Abidin and Pasquire (2005) stated that VM has an abundance of techniques that are used to achieve the best solution to satisfy the client's needs at the lowest cost possible. With the VM capability for eliminating unnecessary cost, it is possible that sustainability could be upheld without unnecessary cost increase.

Fong (2003) highlighted the strength and effectiveness of VM as an effective knowledge creation and transfer tool.

2.11.2 The Relationship of VE with Sustainability

According to Fiksel *et al.*, (1999) there are four fundamental principles can help companies address the challenges associated with measuring and reporting sustainability. These are:

1- Address the dual perspectives of resource consumption and value creation.
2- Include economic, environmental, and societal aspects.
3- Systematically consider each stage in the product life cycle.
4- Develop both leading and lagging indicators.

Based on this literature and by referring to the principles of sustainable development (International Council on Mining and Metals, 2003) the interpretation of sustainability in industry in general and in the mining and metals industry particularly is presented in table (2.1). The industry sustainability principles measurement within VE approach is described in the next section.

2.12 Industry Sustainability Principles Measurement within VE approach

1- RESOURCE CONSUMPTION AND VALUE CREATION: to reach sustainability, organizations should minimize resource consumption while maximizing value creation. Resources are defined to be natural or anthropogenic stocks that are required for the creation, use and disposition of a product or service. Examples of resources include materials, energy, water, labor, land, Human capital, Investment capital …etc, while value is defined as a condition, attributable to a company's activities, which benefits one or more of the organization's stakeholders. Examples of value creation include functional performance, customer satisfaction, environmental quality, economic value added, business competency, human health, social welfare, increased profitability, reduced pollution, improved nutrition …etc (Fiksel *et al.*, 1999). The current study sees that this principle is perfectly aligned with the role played by the value engineering, because value engineering basically seeks to create value.
2- TRIPLE BOTTOM LINE: effective sustainability measurement should consider the complete triple bottom line of economic, environmental, and societal performance (Bennett and James, 1999). Balance between these aspects is essential for the continuation of the company's activities

and create long-term sustainable value and this is in line with the role of value engineering.

3- LIFE CYCLE CONSIDERATION: resource consumption and value creation take place throughout the life cycle, including the supply, manufacturing, use, and disposition of a product and in applying life cycle thinking, it is important to consider not only the physical life cycle of the product, from "cradle to grave", but also the life cycles of relevant facilities and capital equipment both inside and outside the enterprise (Fiksel et al., 1999). This is certainly consistent with the concept of value engineering: "to provide a means of total cost control anywhere during the product/service life cycle, without sacrificing the quality or the reliability of the product or service" (Elias, 1998).

4- LEADING AND LAGGING INDICATORS: **lagging** indicators are measures of the results or outcomes that are attributable to improvements in a company's business processes, it represent a retrospective view of performance, and do not provide managers with foresight about future performance expectations, while **leading** indicators measure internal practices or efforts that are expected to improve future performance. In other words, these indicators help managers monitor their progress toward achieving their sustainability objectives (Fiksel et al., 1999).

Table (2.1)
Sustainable development framework

Sustainable development principles	Interpretation sustainability principles within industry
Implement and maintain ethical business practices and sound systems of corporate governance.	1-Develop and implement company statements of ethical business principles. 2-Implement policies and practices that seek to prevent bribery and corruption. 3-Comply with or exceed the requirements of host-country laws and regulations. 4-Work with governments, industry and other stakeholders to achieve appropriate and effective public policy, laws, regulations and procedures that facilitate the mining, minerals and metals sector's contribution to sustainable development strategies.
Integrate sustainable development within the corporate decision-making process.	1-Integrate sustainable development principles into company policies and practices. 2-Plan, design, operate and close operations in a manner that enhances sustainable development. 3-Implement good practice and innovate to improve social,

Table (2.1) continued…

	environmental and economic performance while enhancing shareholder value. 4-Encourage customers, business partners and suppliers of goods and services to adopt principles and practices that are comparable to own. 5-Provide sustainable development training to ensure adequate competency at all levels among our own employees and those of contractors. 6-Support public policies and practices that foster open and competitive markets.
Uphold fundamental human rights and respect cultures, customs and values in dealings with employees and others who are affected by organization's activities.	1-Ensure fair remuneration and work conditions for all employees and do not use forced, compulsory or child labor. 2-Provide for the constructive engagement of employees on matters of mutual concern. 3-Implement policies and practices designed to eliminate harassment and unfair discrimination in all aspects of our activities. 4-Ensure that all relevant staff, including security personnel, are provided with appropriate cultural and human rights training and guidance. 5- Minimize involuntary resettlement, and compensate fairly for adverse effects on the community where they cannot be avoided. 6- Respect the culture and heritage of local communities.
Implement risk management strategies based on valid data and sound science.	1-Consult with interested and affected parties in the identification, assessment and management of all significant social, health, safety, environmental and economic impacts associated with our activities. 2-Ensure regular review and updating of risk management systems. 3-Inform potentially affected parties of significant risks from mining, minerals and metals operations and of the measures that will be taken to manage the potential risks effectively. 4-Develop, maintain and test effective emergency response procedures in collaboration with potentially affected parties.
Seek continual improvement of health and safety performance.	1-Implement a management system focused on continual improvement of all aspects of operations that could have a significant impact on the health and safety of our own employees. 2-Take all practical and reasonable measures to eliminate workplace fatalities, injuries and diseases among our own employees and those of contractors. 3-Provide all employees with health and safety training, and

Table (2.1) continued…

	require employees of contractors to have undergone such training. 4-Implement regular health surveillance and risk-based monitoring of employees rehabilitate and reintegrate employees into operations following illness or injury, where feasible.
Seek continual improvement of environmental performance.	1-Assess the positive and negative, the direct and indirect, and the cumulative environmental impacts of new projects – from exploration through closure. 2-Implement an environmental management system focused on continual improvement to review, prevent, mitigate or ameliorate adverse environmental impacts. 3-Rehabilitate land disturbed or occupied by operations in accordance with appropriate post-mining land uses. 4-Provide for safe storage and disposal of residual wastes and process residues design and plan all operations so that adequate resources are available to meet the closure requirements of all operations.
Contribute to conservation of biodiversity and integrated approaches to land use planning.	1-Respect legally designated protected areas. 2-Disseminate scientific data on and promote practices and experiences in biodiversity assessment and management. 3-Support the development of scientifically sound, inclusive and transparent procedures for integrated approaches to land use planning, biodiversity, conservation and mining.
Facilitate and encourage responsible product design, use, re-use, recycling and disposal of products.	1-Advance understanding of the properties of metals and minerals and their life-cycle effects on human health and the environment. 2-Conduct or support research and innovation that promotes the use of products and technologies that are safe and efficient in their use of energy, natural resources and other materials. 3-Develop and promote the concept of integrated materials management throughout the metals and minerals value chain. 4-Provide regulators and other stakeholders with scientifically sound data and analysis regarding products and operations as a basis for regulatory decisions. 5-Support the development of scientifically sound policies, regulations, product standards and material choice decisions that encourage the safe use of mineral and metal products.
Contribute to the social, economic and institutional	1-Engage at the earliest practical stage with likely affected parties to discuss and respond to issues and conflicts concerning the management of social impacts.

Table (2.1) continued…

Development of the communities.	2-Ensure that appropriate systems are in place for ongoing interaction with affected parties, making sure that minorities and other marginalized groups have equitable and culturally appropriate means of engagement. 3-Contribute to community development from project development through closure in collaboration with host communities and their representatives. 4-Encourage partnerships with governments and non-governmental organizations to ensure that programs (such as community health, education, local business development) are well designed and effectively delivered. 5-Enhance social and economic development by seeking opportunities to address poverty.
Implement effective and transparent engagement, communication and independently verified reporting arrangements with stakeholders.	1-Report on our economic, social and environmental performance and contribution to sustainable development. 2-Provide information that is timely, accurate and relevant. 3-Engage with and respond to stakeholders through open consultation processes.

The current study will cover aspects and other activities that affect the sustainable value creation, and reduce of the risks which are included in the questionnaire, as follows:

1- Human rights
2- Labour rights
3- Anti-corruption
4- The environment
5- Responsible business conduct
6- Health, working environment and safety
7- Resource consumption.
8- Triple bottom line (economic, environmental, and societal aspects).
9- Leading and lagging indicators.
10- Life cycle consideration.

2.13 Previous Studies

Wilson, (2005): this study summarized the current VE practices in highway transportation agencies in the United States and Canada. This study was developed using information collected during a detailed literature search and from documents provided by or available from selected transportation agencies and municipalities in North America. In addition, a survey questionnaire was distributed to transportation agencies in the United States

and Canada. The survey questionnaire, sent to U.S. and Canadian transportation agencies and selected municipalities, was structured to gain an understanding of current practices in VE, and the challenges and opportunities that exist. Fifty agencies participated in the survey. The results suggested that approximately two-thirds of the respondents (33 of 50) indicated that the statutory requirement was "always" or "often" the reason that VE was being used. About half of the respondents (27 of 50) indicated that VE was done to meet their funding requirements.

Daddow and Skitmore, (2005): this study examined Value Management (VM) practice in the property and construction industry, mainly from Australia. The survey described in this study identified the actual experiences and observations of a sample of 17 professionals working in the property and construction industry concerning the VM process and outcomes. The main finding was that VM is certainly popular among those with experience in its use, with an average 33% acceptance of the VM workshop.

Zainul Abidin and Pasquire (2005): this study explored VM as a means to uplift sustainability issues at the early construction stages. Two field studies have been conducted. Study 1 was a minor study intended as a pre-survey before Study 2 took place. The purpose was to overview the diffusion of VM and sustainability knowledge among practitioners from various construction companies. Study 2 aimed to investigate the absorption of sustainability issues within VM practices and the perception of VM practitioners with this subject. The pre-survey study, called Study 1, was conducted in December 2002 with 293 questionnaires distributed via post the sample consists of various construction practitioners representing various companies i.e. client, architect, design engineer, project manager, specialist manufacturer, contractor and others (cost consultant, value manager, risk manager etc.). Field study 2 was conducted in February 2003 with 360 questionnaires distributed to various VM practitioners. The questionnaires consist of a mixture of open, closed and scaled type questions. It is confirmed that sustainability consideration is already inherent in the VM workshops but the level of attention varies between workshops. There are gaps in current practices, indicating rooms for improvement. The identified barriers to integration are believed responsible for these gaps.

Bowen, Jay, and Cattell, (2009): this study investigated the awareness and practice of VM by South African architects – in essence a "temperature-check" of current practice. Data were collected from registered Pr.Arch using a web-based, online questionnaire survey. As at July 2008, 2,606 architects were registered with the South African Council for the Architectural Profession (SACAP). The results suggested that awareness of VM is not

widespread among South African architects, and that its actual practice is minimal. Where VM was used on projects, it was invariably cost-minimization driven in terms of both the project and the VM process itself.

Al-Yousefi, (2009): this paper proposed a conceptual synergy between VE and sustainable construction (SC) that leads to achieving best value over the life span of a project. It demonstrated the linkage within the SAVE International Standard VE Job Plan tools and techniques for better planning for Sustainable Construction (SC) during early stages of a project. This study concluded that VE methodology employs various tools and techniques that help us to plan for better sustainable construction (SC).

Al-Saleh and Taleb, (2010): this study investigated the idea "value management (VM) has been proposed as a potential mechanism for delivering sustainable construction projects in some countries" in the Gulf Cooperation Council (GCC) countries through inter-viewing 17 experienced value managers from the GCC. The primary conclusion, derived from the viewpoints of these value managers, is that such an endeavor might be unviable at present, largely due to a lack of awareness with regard to sustainability issues in the GCC. Proposals are therefore provided to assist in a successful integration of sustainability into VM practices in the GCC region.

Idrus *et al*., (2010): this study investigated the level of awareness with value engineering practices and the level of implementation of the value engineering techniques in the Malaysian construction industry. The study combined literature reviews and questionnaire survey. Twenty three (23) consultants were involved in the survey. The findings of the study indicated that the level of awareness of value engineering is high and the level of value engineering implementation was found to be relatively average.

El-Alfy, (2010): this article proposed a method for improving building sustainability. The proposed method utilizes the job plan of the value engineering program – together with a database that contains up-to-date information on construction systems and materials – as a gear for studying and analyzing the sustainability requirements. This article has presented a method to assist in designing sustainable buildings. The value engineering approach and a database of available systems with classification of how each system complies with the different sustainability factors are proposed to be used during the system's selection process.

Bowen, Cattell, and Jay, (2011): this study investigated the nature and extent of value management (VM) practice in the South African manufacturing industry, in addition to exploring engineers' and designers' awareness and understanding of VM and the nature and extent of the use of VM techniques within their companies. Using a web-based, online survey

questionnaire, data were collected from 82 respondents drawn from the manufacturing industry. The results suggested that while VM is generally known among engineers and designers in the manufacturing sector in South Africa, it is less widely practiced. VM is seen predominantly as a cost reduction tool. This misperception, and the lack of awareness of the potential benefits of VM, must be remedied if the South African manufacturing industry is to remain competitive. The industry needs to adopt best practice VM techniques and standards.

Perera, Hayles, and Kerlin, (2011): this study assessed the use and effectiveness of the value management within the construction industry in Northern Ireland. A mixed mode research methodology was adopted for this study. It involved the use of a postal questionnaire survey to gather broad views of use of VM from participants operating within the Northern Ireland construction industry and augmenting and verifying the initial findings through a series of case studies. Random sampling was adopted for this research. The population from which the sample was to be taken from was identified and a list of companies from Northern Ireland was drawn up. This list included clients, architects, engineers, quantity surveyors and contractors. The population concerned included 172 architects, 111 quantity-surveying practices and 184 contractors. A sample of 100 was selected from this with a view of obtaining a required response sample of 40. About 100 questionnaires were then distributed to professionals working in these companies. This study showed that VM is frequently used within the Northern Ireland construction industry and on the whole is quite effective. However, the research exposed a general consensus that the VM process is frequently not implemented at the most appropriate stage of a project, which suggests that if it was, it could perhaps be more effective than it is at present. There was an apparent lack of formal methods used to carry out the VM process. Instead, rather loose and informal methods are used.

Borges, (2012): this study provided insight into sustainability's business management concepts to enable greater understanding, if not mutual respect, among all parties, and how making money by doing sustainability and green management concept through Supply-Chain, Value-System, Value-Engineering and Lifecycle Concepts. This study concluded that when corporate environmental sustainability done right, enables a progressive for-profit company to: Make money by doing good!

A summary of the previous studies is shown in table (2.2).

Table (2.2)
A summary of the previous studies

Author(s) and Year	Title of study	Country / Sample size	Study object	Major finding
Wilson, (2005)	Value Engineering Applications in Transportation	United States and Canada / 50 agencies	Summarize the current VE practices in highway transportation agencies	33 of the respondents indicated that the statutory requirement was "always" or "often" the reason that VE was being used. 27 of the respondents indicated that VE was done to meet their funding requirements
Daddow and Skitmore, (2005)	Value Management in Practice: An interview Survey	Australia / 17 professionals	Examine value management (VM) practice in the property and construction industry	VM is certainly popular among those with experience in its use, with an average 33% acceptance of the VM workshop
Zainul Abidin and Pasquire, (2005)	Delivering sustainability through value management: Concept and performance overview	UK / study 1 (293), study 2 (360), various construction practitioners	Explore VM as a means to uplift sustainability issues at the early construction stages	Sustainability consideration is already inherent in the VM workshops but the level of attention varies between workshops

Author(s) and Year	Title of study	Country / Sample size	Study object	Major finding
Bowen, Jay, and Cattell, (2009)	Value management awareness and Practice by South African architects: An empirical study	South African / 2,606 architects	Investigate the awareness and practice of VM by South African architects	Awareness of VM is not widespread among South African architects, and that its actual practice is minimal
Al-Yousefi, (2009)	The synergy between value engineering and sustainable construction	No sample selected	Proposes a conceptual synergy between VE and Sustainable Construction that leads to achieving best value over the life span of a project.	VE Methodology employs various tools and techniques that help us to plan for better Sustainable Construction (SC).
Al-Saleh and Taleb, (2010)	The integration of sustainability within value management practices: a study of experienced value managers in the GCC countries	GCC countries / 17 experienced value managers	Investigate the idea “VM has been proposed as a potential mechanism for delivering sustainable construction projects”	A lack of awareness with regard to sustainability issues in the GCC.
Idrus, *et al*., (2010)	The implementation of value engineering among malaysian construction consultants	Malaysian / 23 consultants	Investigate the level of awareness with VE practices and the level of implementation of the VE techniques	The level of awareness of VE is high and the level of VE implementation was found to be relatively average

Author(s) and Year	Title of study	Country / Sample size	Study object	Major finding
El-Alfy, (2010)	Design of sustainable buildings through value engineering	No sample selected	Proposes a method for improving building sustainability	The value engineering approach and a database of available systems with classification of how each system complies with the different sustainability factors are proposed to be used during the system's selection process
Bowen, Cattell, and Jay, (2011)	Value management in the South African manufacturing industry: exploratory findings	South African / 82 respondents	Investigate the nature and extent of value management (VM) practice .in the manufacturing industry	VM is generally known among engineers and designers in the manufacturing sector in South Africa, it is less widely practiced
Perera, Hayles, and Kerlin, (2011)	An analysis of value management in practice: the case of Northern Ireland's construction industry	Northern Ireland / 100	Assess the use and effectiveness of the value management within the construction industry	This study showed that VM is frequently used within the Northern Ireland construction and quite effective

Author(s) and Year	Title of study	Country / Sample size	Study object	Major finding
Borges, (2012)	Making money by doing good: sustainability's value proposition at for-profit companies	No sample selected	Provides insight into sustainability's business management, and how making money by doing sustainability and green management concept through Supply-Chain, Value-System, Value-Engineering and Lifecycle Concepts	This study concluded that when corporate environmental sustainability done right, enables a progressive for-profit company to: Make money by doing good!

It can be noted from these prior studies that most of them focused on measuring the awareness and use of value engineering in the organizations in countries such as US, Canada, Australia, countries from Europe, countries from East Asia, South Africa, and Arab Gulf countries, while none of these studies were conducted in Jordan. From other hand, none of the studies except (Borges, 2012) have linked value engineering with concepts, such as sustainable value, green efficiency and green management, and the rest of studies which talked about sustainability, discussed the link between value engineering and the construction sustainability only (Al-Yousefi, 2009; El-Alfy, 2010; Zainul Abidin and Pasquire, 2005).

The current study characterized through its coverage of aspects not covered by previous studies (through prolonged search of the current study), and these aspects as follows:

1- Measurement of awareness and practice of value engineering in Jordanian industry sector which has not been addressed or searched (by the extensive research of the current study).
2- Study sustainable value in Jordanian industry sector through value engineering, the few studies that have been mentioned did not address the industry sector and only focused on the buildings sector, add to that no studies looked at the subject in Jordan (by the extensive search of the current study).

3- Study of the "culture of sustainability" in the Jordanian industry sector and the level of application, and study the aspects that are usually overlooked which form great importance to sustainable value creation, such as human and workers' rights, anti corruption, and resource consumption, which constitutes an important addition to the study.
4- Shed light on the broader and more comprehensive concept of sustainability represented by "get the junk out, sustainability then comes out".

Chapter Three
Design and Methodology

This chapter is concerned with research methodology. It includes research design, data collection methods, population and sample, questionnaire design, operational definitions and sample profile.

3.1 The Research Design

'Research: a way of examining your practice… (Kumar, 2005).

Research design is the conceptual structure within which research would be conducted. The function of research design is to provide for the collection of relevant information with minimal expenditure of effort, time and money. The preparation of research design, appropriate for a particular research problem, involves the consideration of the following: objectives of the research study, methods of data collection to be adopted, source of information—sample design, tool for data collection, data analysis qualitative and quantitative (kumar, 2005).

In the current study, a quantitative research will be used. Leedy (1997) defined a quantitative study as "an inquiry into social or human problems, based on testing a theory composed of variables, measured with numbers and analyzed with statistical procedures in order to determine whether the predictive generalizations of the theory hold true". Quantitative research is interested in questions of how much, or how well, or to whom does the phenomenon in concern apply (Won, 2004). Thus, quantitative research fits to achieve the objectives of this study.

3.2 Population and Sample Selection

Population refers to the entire group people, events, or things of interest that the researcher wishes to investigate whereas, research sample refers to a subset of the population and comprises some members selected from it (Sekaran, 2004). The population of the work from which the sample was taken, from two companies (JPMC and APC) in Jordanian industry sector. A list included engineers and managers at different positions (director, associate director, department head… etc). A total of 100 managers and engineers representing the research sample were approached for data collection under the request of human resources directors in both companies. A total of 67 usable questionnaires were received and were used for data analysis. As shown in table (3.1). The central administration of Phosphate Company was excluded because their human resources directors refused to cooperate and distribute the questionnaire.

Table (3.1)
Respondents to questionnaire survey

Area of industry	No. of responses	Percentage of responses (%)	Cumulative percentage (%)	No. distributed
Engineer	30	45	45	-
Manager	37	55	55	-
Total	**67**	**100**	**100**	**100**

3.3 Data Collection Methods

This study is based on two sources to obtain the data:

1- Secondary data: from literature (books, previous researches, and websites).
2- Primary data: from two cases of studies which are Jordan Phosphate Mines Company and Arab Potash Company by using survey questionnaire and annual reports. A questionnaire survey has been developed to obtain and measure the study variables.

3.4 Questionnaire Design

This study developed a questionnaire based on previous studies (Fong, 1998 and Value Creation Initiative Questionnaire, 2009). A sectioned questionnaire was employed utilizing of closed-ended questions, the questionnaire was judged by academic staff at Mutah University and others. The survey questionnaire consists of four sections. Section (A) focuses on demographic information such as membership of VE institutions, position within the organisation, experience and the organization manufacturing activities. Section (B) explores respondents' familiarity with the concept of VE. Section (C) examines the practice of VE within the organisation. Section (D) examines the sustainable value creation in the organisation. The structure of the questionnaire is given in table (3.2).

Table (3.2)
The structure of the survey questionnaire

Section	Structure
Section A. Demographic information	Respondent and company profile.
Section B. Awareness of value engineering	Multiple choice is used to assess respondents' awareness of VE and Measuring the willingness to learn more about VE.

Section C. Practice of value engineering	Multiple choice is used to investigate VE practice in the organisation and if the respondent has ever been involved in a VE exercise.
Section D. Sustainable value creation	Multiple choice is used to examine the strategic plans for sustainable value creation and if the company is a member of the UN Global Compact or not. The section then proceeds if the company has policies covering human and labour rights, environmental protection, anti-corruption, responsible business conduct, health, working environment and safety and the rest of the principles of sustainability

3.5 Operational Definitions

Value Engineering Awareness and Practice

Fong (1998) developed an instrument of six-items to examine the level of knowledge (awareness) of value engineering amongst owners and the current usage (practice) of value engineering by owners, in addition to the owners' willingness to learn more about value engineering. Tables (3.3) and (3.4) illustrate of the six items. In addition to, in the current study one item from online survey published by University of Cape Town (2011) was chosen to measure the awareness of value engineering, as illustrated in table (3.3), item No. 2, and two other items also were chosen from the same online survey to measure the practice of value engineering, as illustrated in table (3.4), items No. 2 and 3.

Table (3.3)
Items used to measure value engineering awareness

Item No.	Questions
1	Have you ever heard of the terms value engineering, value analysis or value management before receiving the questionnaire?
2	Where did you first hear about Value engineering?
3	Value engineering is another name for a cost-saving exercise, or a quality control.
4	Are you interested in learning more about value engineering and its application?

Table (3.4)
Items used to measure value engineering practice

Item No.	Questions
1	Is value engineering used in your current organization?
2	How many value engineering exercises have you been involved in (approximately)?
3	What are the most important factors that prevent the use of value engineering in your job or company?
4	What is your perception of value engineering as compared with other cost control techniques?
5	Are you willing to pay the cost of any study provided by value engineering?

Sustainable Value Creation

This study opted to use seven items (1-7) developed by the Sustainable Value Creation Initiative Questionnaire (2009), In addition to five items (8-12) that have been added by the researcher, which have been summarized from the literature, specifically from the study of Fiksel *et al*., (1999) and Borges, (2012), in order to give a comprehensive look and more suitable for this variable according to the opinion of the current study. The selected items cover areas that are essential to sustainable value creation. Illustrated in table (3.5):

1- Human rights.
2- Labour rights.
3- Anti-corruption.
4- Health, working environment and safety (HES).
5- Resource consumption.
6- Triple bottom line (economic, environmental, and societal aspects).
7- Leading and lagging indicators.
8- Unwanted and inefficient junk in the company various activities.
9- Life cycle consideration.

Table (3.5)
Items used to measure sustainable value creation

Item No.	Questions
1	Does the company have strategic plans for sustainable value creation?
2	Is the company a member of the UN Global Compact?
3	Does the company have policies covering human and labour rights?
4	Does the company have policies covering environmental protection?
5	Does the company have policies covering anti-corruption?
6	Does the company have policies covering responsible business conduct?
7	Does the company have policies covering health, working environment and safety?
8	Does the company have policies that seek to reduce the consumption of resources?
9	Does the company have policies that seek to find a balance between economic, environmental, and societal performance?
10	Does the company have policies to monitor their progress toward achieving their goals for example, use (lagging indicators) to measure the results or outcomes and (leading indicators) to measure internal practices or efforts that are expected to improve future performance?
11	Does the company have policies targeted rid of unwanted and inefficient junk from its various activities, such as delays, mistakes, defects, waste of all kinds, Accidents, Negligence ... etc.?
12	Does the company have policies covering life cycle consideration?

3.6 Sample Profile

A total of 100 managers and engineers representing the research sample were approached for data collection. A total of 67 engineers and managers completed a questionnaire (n=67). The majority of education level of respondents is bachelor degree (61.2%), while the minority is the master and PhD degrees (1.5%) for each degree, while 35.8% represented diploma degree. As for the years of experience we note that a majority of the answers were more than ten years by (86.6%). Membership of value engineering organizations such as the Institute of Value Management (IVM) or Society of American Value Engineers (SAVE) International is practically not-existent, and about 27% of respondents answered that the company has a membership of a professional VE institution without mentioned the name of the Institute. As shown in table (3.6) and figure (3.1).

Table (3.6)
Frequencies and percentages of respondents according to their demographic variables

Measure		**Frequency**	**Percent of responses (%)**
Educational level	Diploma	24	35.8
	Bachelor	41	61.2
	Master	1	1.5
	PhD	1	1.5
	Total	**67**	**100**
Number years of experience in the current job	Less than 3 years	5	7.5
	3-6 years	0	0.0
	7-10 years	4	6.0
	More than 10 year	58	86.6
	Total	**67**	**100**
Membership of a professional VE institution	IVM	2	3.0
	SAVE	0	0.0
	None	35	52.5
	Other	18	26.9
	Total	55	82.1
	Missing	12	17.9
	Total	**67**	**100**

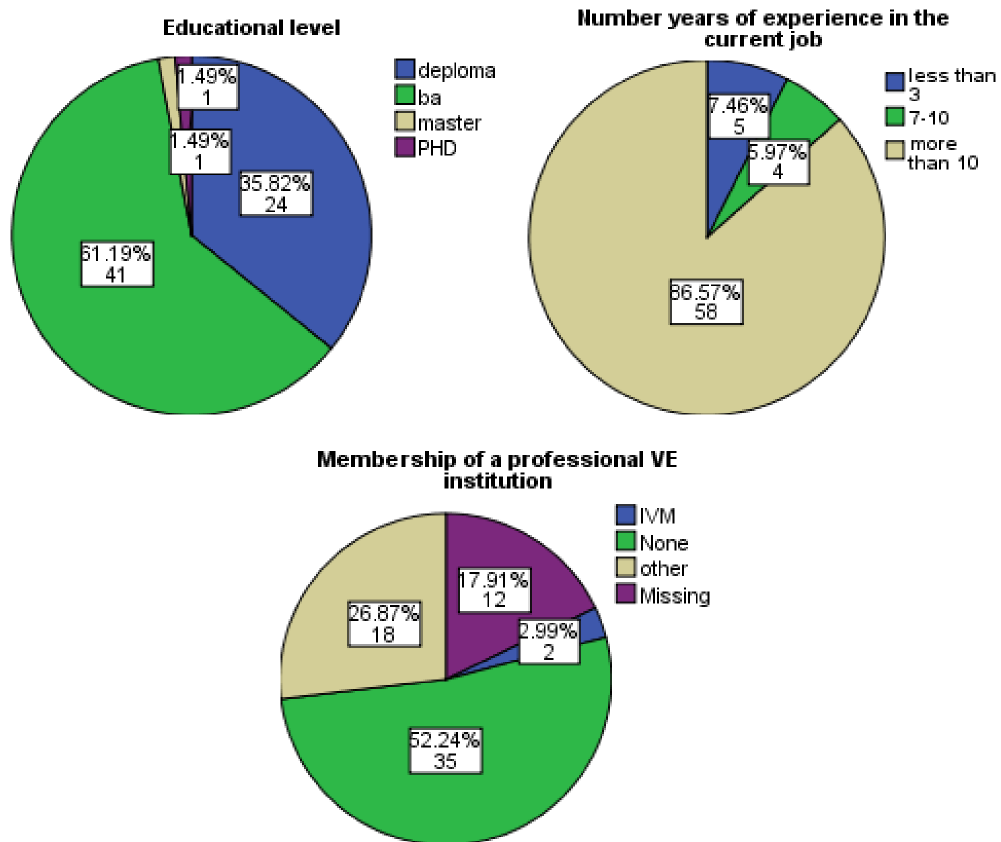


Figure (3.1)
Frequencies and percentages of respondents according to their demographic variables

Chapter Four
Data Analysis, Discussion and Conclusions

This chapter covers the following areas: data analysis, discussion of the results, conclusion, recommendations and limitations of the study.

4.1 Analyses Technique

The survey data were analysed using (Statistical Package for the Social Sciences: Version 16.0 for windows). Mainly descriptive statistical measures were used, such as frequencies and percentages given below relate to the responses to individual questions. Unless otherwise stated mean and standard deviation for describing the study variables. The results are described, utilising tables. Detailed discussion of the results and relating the findings to other studies follows in the next sections after the analysis presented here.

4.2 Analysis of Questionnaire Statements

Awareness of value engineering

AW1: have you ever heard of the terms value engineering, value analysis or value management before receiving the questionnaire?

Respondents were asked whether they had heard the terms value engineering, value analysis or value management before receiving the questionnaire. 56.72% (n=38) of the respondents had heard of value engineering and there answers were (yes clear or yes not clear). Of those 38 respondents, 32.84% (n=22) had heard of the term, but were not clear about it until they had read the given definition. 23.88% (n=16) of them claimed they had a clear understanding of what it was and familiar with it, which indicates that awareness of VE is not widespread among employees. Figure (4.1) below is shown the results.

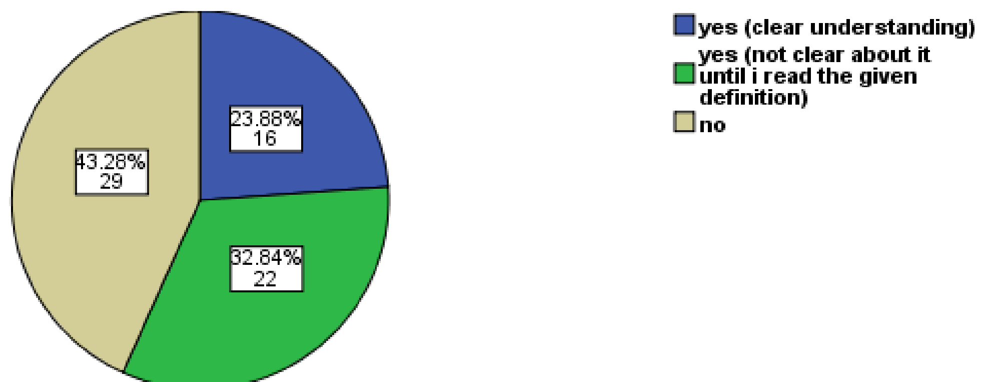


Figure (4.1)
Frequencies and percentages - AW1

AW2: where did you first hear about value engineering?

Respondents reported various ways in which they had first heard about VE. From their Professional Institution 6%; from their own company 9%; from an academic establishment or from a course that they attended 11.9%; via an industry newsletter or via online media such as the internet 17.9%; and "other" means 9%. Other sources included training courses and scientific discussion and debate. Figure (4.2) below is shown the results.

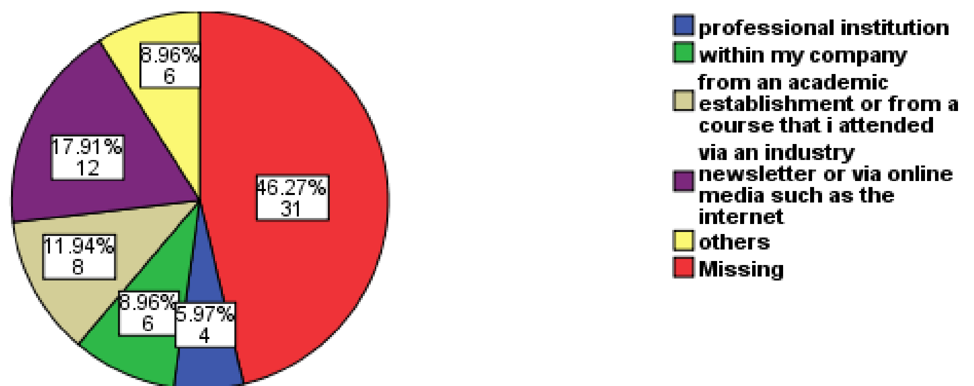


Figure (4.2)
Frequencies and percentages – AW2

AW3: value engineering is another name for a cost-saving exercise, or a quality control?

Of those 38 respondents claiming to be aware and had heard of value engineering, 97.4% of respondents had even thought that it was another name for a cost-saving exercise, or a quality control technique, which means inaccurate perceptions and a lack of knowledge. Figure (4.3) below is shown the results.

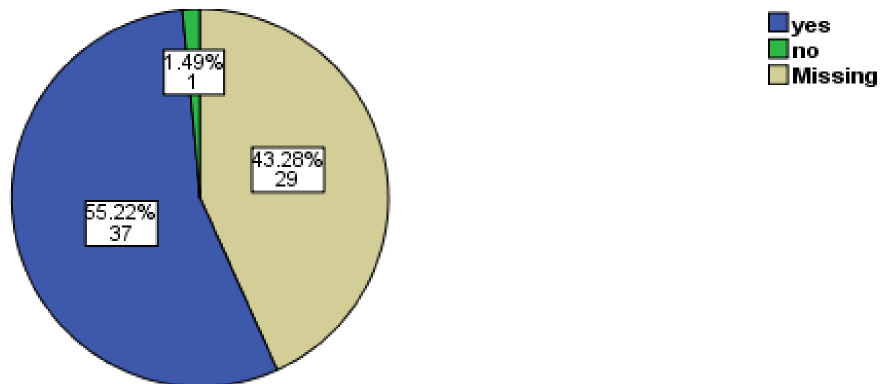


Figure (4.3)
Frequencies and percentages – AW3

AW4: are you interested in learning more about Value Engineering and its application?

When respondents were asked if they are interested in learning more about value engineering and its application, 88.1% gave a positive response. Figure (4.4) below is shown the results.

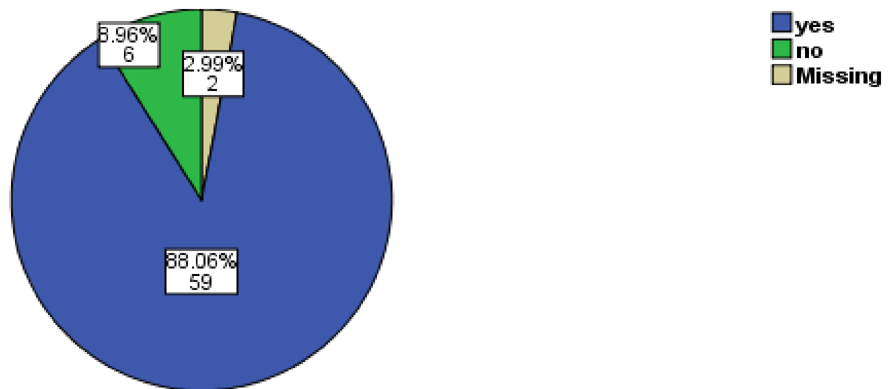


Figure (4.4)
Frequencies and percentages – AW4

Practice of value engineering

PR1: is value engineering used in your current organization?

When respondents were asked about the current usage of value engineering within the firm only 20.9% (n=14) of respondents claimed that value engineering is used in the firm, 22.4% (n=15) claimed the opposite, 35.82% (n=24) not sure, 19.4% (n=13) cited in some aspects only. It can be noted that the answers are close from each other, and the views vary in terms of the use of value engineering or not, and this demonstrates that there is no actual usage of value engineering in the company. Figure (4.5) below is shown the results.

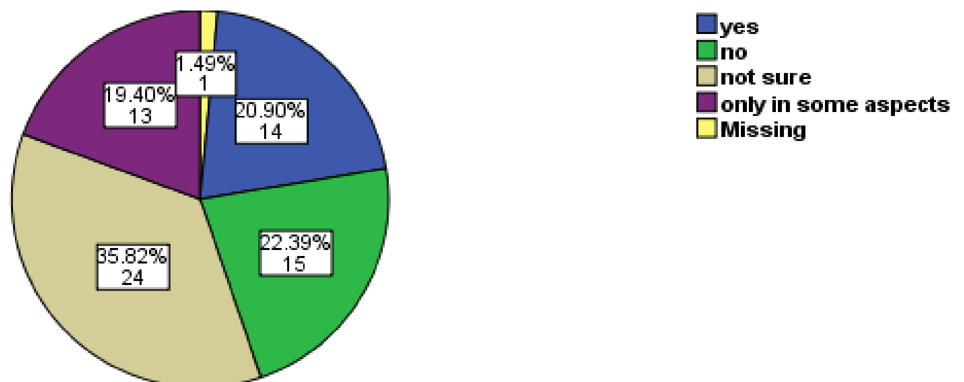


Figure (4.5)
Frequencies and percentages – PR1

PR2: how many value engineering exercises have you been involved in (approximately)?

When questioned about the number of value engineering exercises. Of those 16 respondents claiming to be aware of VE, only 10 (62.5%) answered yes they have, report ever having participated in a VE exercise; representing 14.9% per cent of the total sample. It can be concluded that the number of exercises is very low based on the percent of 14.9. Figure (4.6) below is shown the results.

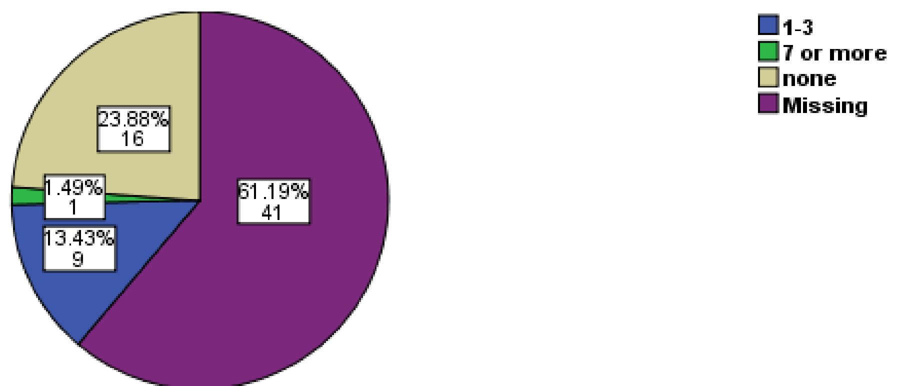


Figure (4.6)
Frequencies and percentages – PR2

PR3: what are the most important factors that prevent the use of value engineering in your job or company?

About 14.9% (n=10) of the respondents indicated it was the administrative legislations, under "others" 13.4% (n=9). "Others" reason cited included the absence of training internally and externally and if it is existed it is limited for certain persons, no encouraging for development, and one of the respondents said "who cares!" figure (4.7) below is shown the results.

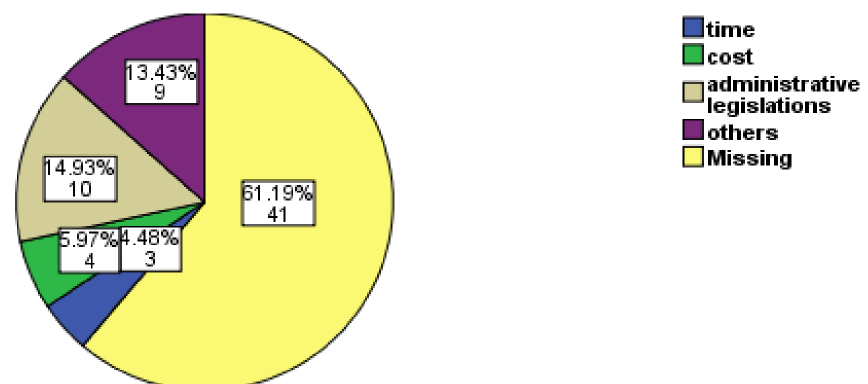


Figure (4.7)
Frequencies and percentages – PR3

PR4: what is your perception of value engineering as compared with other cost control techniques?

When respondents were asked about their perception of value engineering as compared with other cost control techniques, 19.4% said it is a good way of achieving “value for money”. About 17.9% considered value engineering to be the same as other cost control techniques, just different names. Again this demonstrates the inaccurate perceptions and a lack of knowledge. Figure (4.8) below is shown the results.

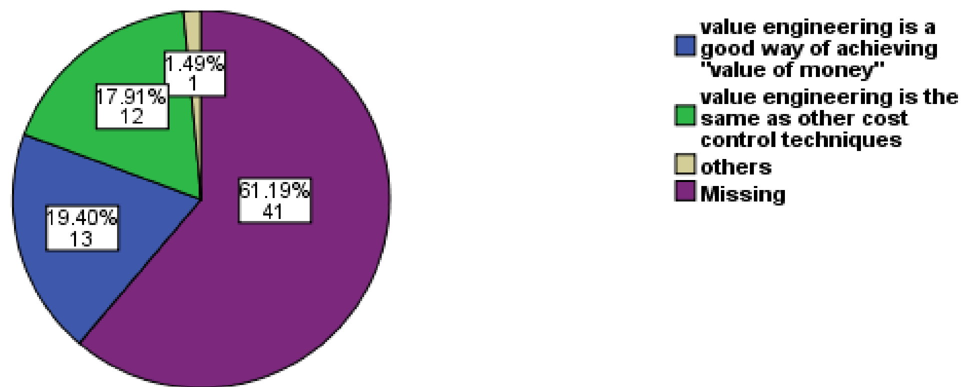


Figure (4.8)
Frequencies and percentages – PR4

PR5: are you willing to pay the cost of any study provided by Value Engineering?

About 37.9% said that they would pay. 50% said they would not. Figure (4.9) below is shown the results.

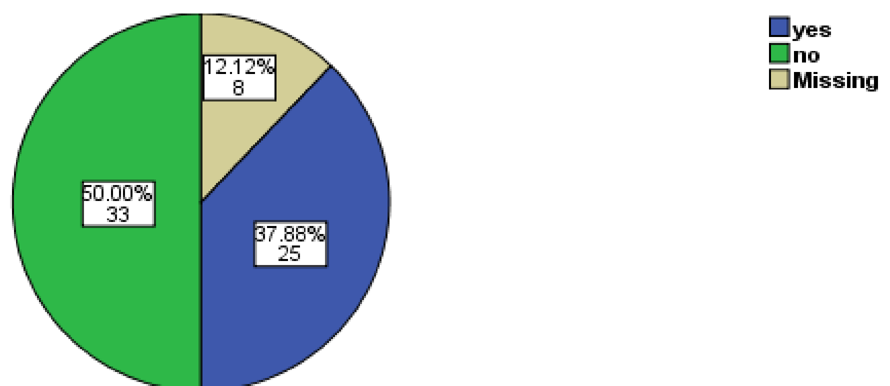


Figure (4.9)
Frequencies and percentages – PR5

Sustainable value

SV1: does the company have strategic plans for sustainable value creation?

When questioned about the strategic plans for sustainable value creation the answers as follows, continuously 25.4%; Now and then 32.8%; yearly 10.4%; rarely 14.9%; never 7.5%. Figure (4.10) below is shown the results.

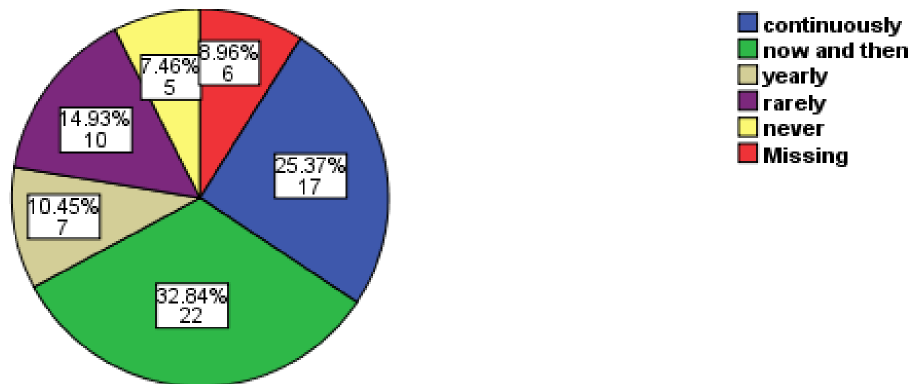


Figure (4.10)
Frequencies and percentages – SV1

SV2: is the company a member of the UN Global Compact?

About 50.7% (n=34) of respondents said they are not familiar with the UN global compact, 19.4% said the company is not a member in UN global compact, 16.4% said the company is a member, only one respondent mentioned that the company planning to become a member. We can see that most of respondents are not familiar with the UN global compact. Figure (4.11) below is shown the results.

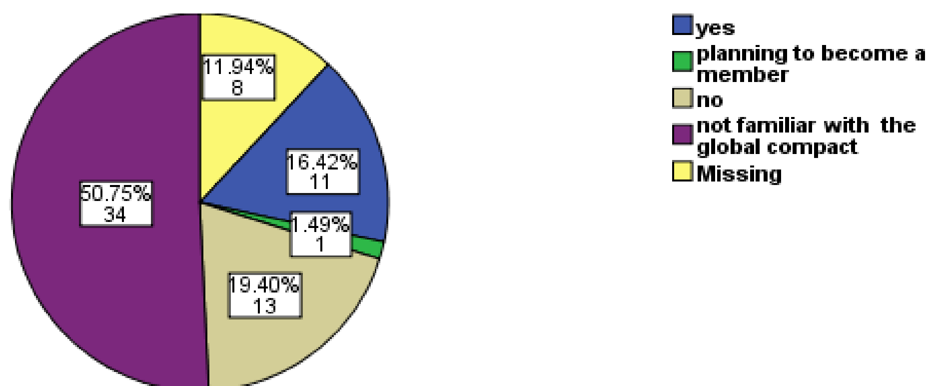


Figure (4.11)
Frequencies and percentages – SV2

Respondents were requested to indicate on a scale of 1-4 (1- no; 2- no, but policies are planned; 3- yes, but only internally available; 4- yes, and the policies are publicly available). The results are depicted in table (4.1).

Table (4.1)
Descriptive statistics on a scale of 1-4 values for evaluation of attitudes towards sustainable value

Question	Mean	Standard deviation	Ranking
Human and labour rights	3.2540	1.03126	4
Environmental protection	3.3770	0.98597	1
Anti-corruption	2.8710	1.28655	6
Responsible business conduct	3.3226	0.97130	3
Health, working environment and safety	3.3333	1.04727	2
Consumption of resources	1.9254	0.97411	9
Balancing between economic, environmental, and societal performance	2.4627	1.06356	7
Lagging and leading indicators	2.8955	0.92334	5
Unwanted and inefficient junk	2.1642	0.80898	8
Life cycle consideration	3.2540	1.03126	4

We can note that the highest Mean represents question number two, most of respondents agreed that the company has policies covering environmental protection, while the lowest Mean represents question number six, most of respondents agreed that the company does not have clear policies to reduce the consumption of resources.

SV3: does the company have policies covering human and labour rights?

About 53% of respondents answered yes, and the policies are publicly available, 20.6% answered yes, but only internally available, 8.8% answered no, but policies are planned, 10.3% answered no. Most of respondents agreed that the policies are covered and available publicly and internally. Figure (4.12) below is shown the results.

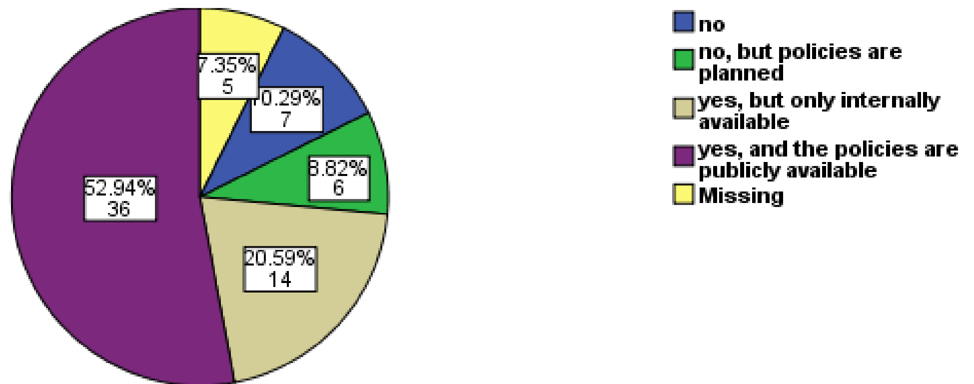


Figure (4.12)
Frequencies and percentages – SV3

SV4: does the company have policies covering environmental protection?

57.35% of respondents answered yes, and the policies are publicly available, 17.65% answered yes, but only internally available, 5.9% answered no, but policies are planned, 8.8% answered no. Most of respondents agreed that the policies are covered and available publicly and internally. Figure (4.13) below is shown the results.

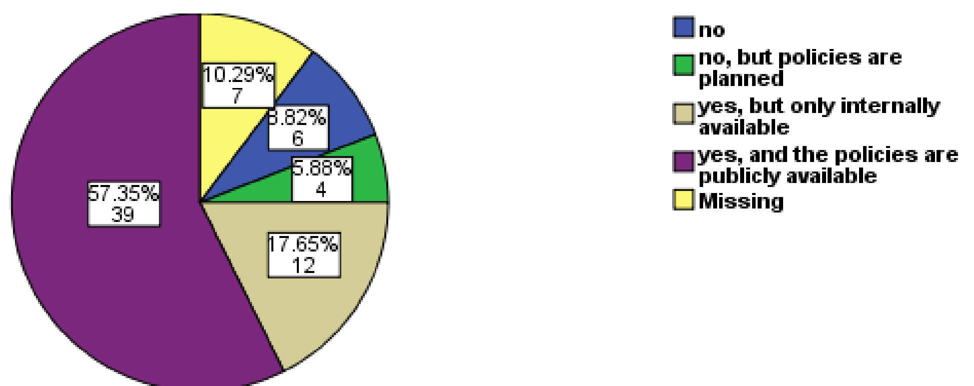


Figure (4.13)
Frequencies and percentages – SV4

SV5: does the company have policies covering anti-corruption?

About 45.6% of respondents answered yes, and the policies are publicly available, 11.76% answered yes, but only internally available, 10.3% answered no, but policies are planned, 23.53% answered no. Figure (4.14) below is shown the results.

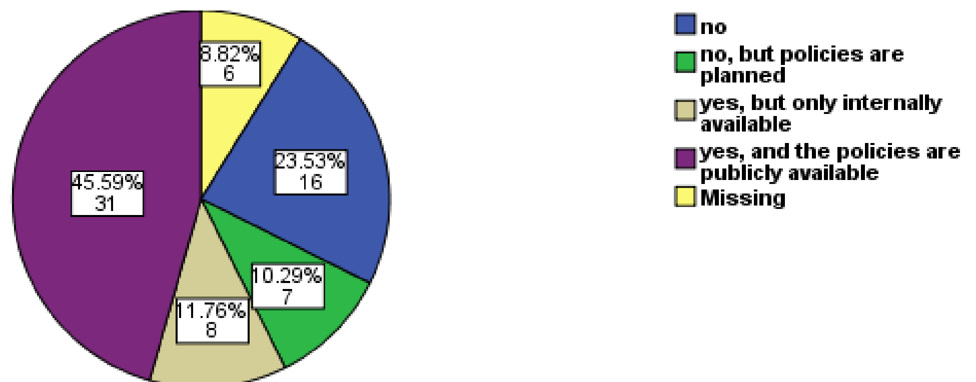


Figure (4.14)
Frequencies and percentages – SV5

SV6: does the company have policies covering responsible business conduct?

About 53% of respondents answered yes, and the policies are publicly available, 23.53% answered yes, but only internally available, 5.9% answered no, but policies are planned, 8.8% answered no. Most of respondents agreed that the policies are covered and available publicly and internally. Figure (4.15) below is shown the results.

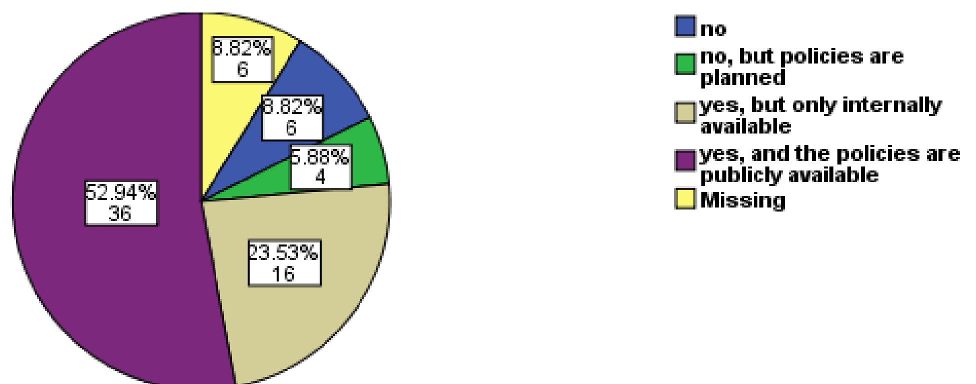


Figure (4.15)
Frequencies and percentages – SV6

SV7: does the company have policies covering health, working environment and safety?

About 60.3% of respondents answered yes, and the policies are publicly available, 13.24% answered yes, but only internally available, 8.8% answered no, but policies are planned, 10.3% answered no. Most of respondents agreed that the policies are covered and available publicly and internally. Figure (4.16) below is shown the results.

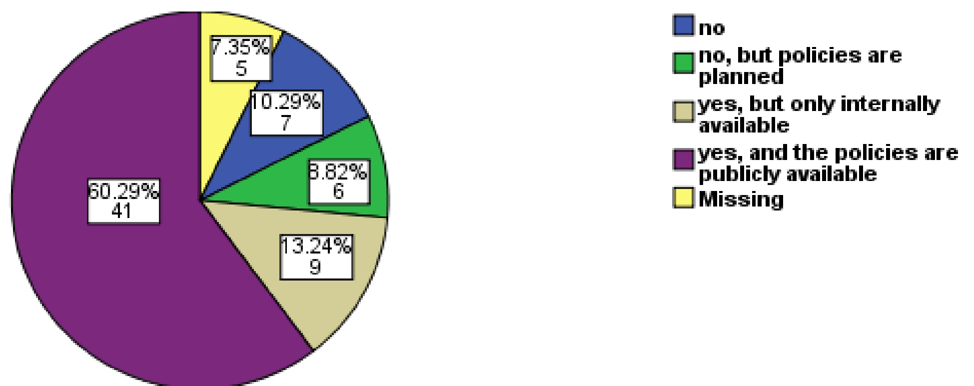


Figure (4.16)
Frequencies and percentages – SV7

SV8: Does the company have policies that seek to reduce the consumption of resources?

7.35% of respondents answered yes, and the policies are publicly available, 20.6% answered yes, but only internally available, 27.94% answered no, but policies are planned, 42.65% answered no. Most of respondents agreed that the company does not have policies that seek to reduce the consumption of resources at the planning level or in general. Figure (4.17) below is shown the results.

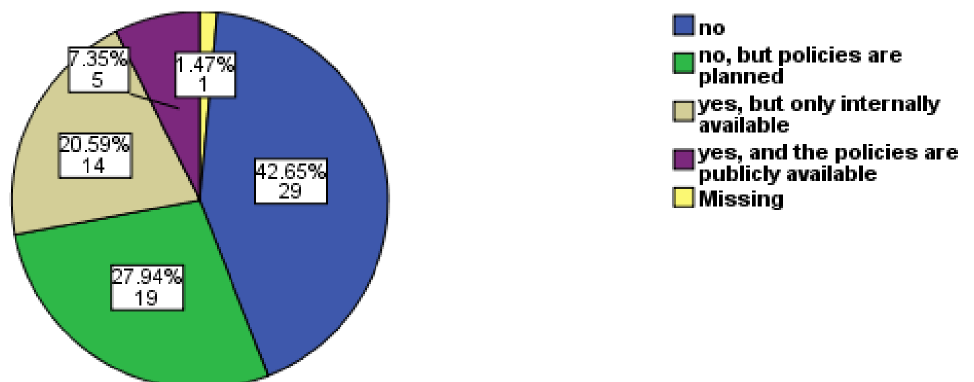


Figure (4.17)
Frequencies and percentages – SV8

SV9: Does the company have policies that seek to find a balance between economic, environmental, and societal performance?

17.65% of respondents answered yes, and the policies are publicly available, 35.3% answered yes, but only internally available, 20.6% answered no, but policies are planned, 25% answered no. Almost half of the respondents agreed that the company has policies that seek to find a balance between economic, environmental, and societal and available internally and publicly. Figure (4.18) below is shown the results.

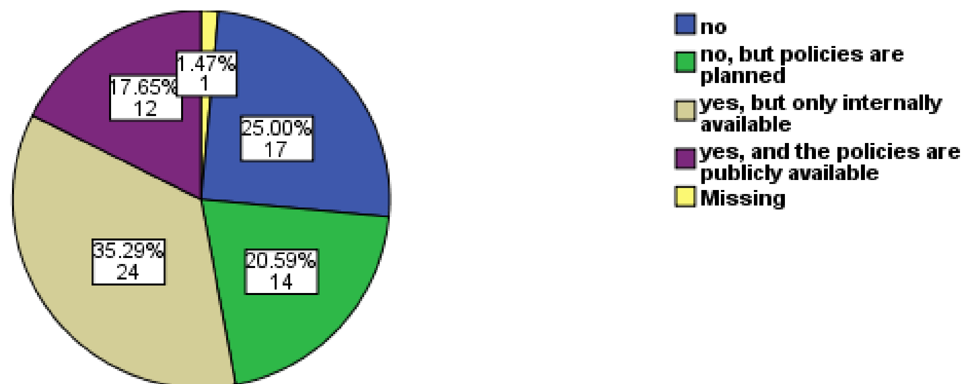


Figure (4.18)
Frequencies and percentages – SV9

SV10: Does the company have policies to monitor their progress toward achieving their goals for example, use (lagging indicators) to measure the results or outcomes and (leading indicators) to measure internal practices or efforts that are expected to improve future performance?

29.4% of respondents answered yes, and the policies are publicly available, 36.76% answered yes, but only internally available, 25% answered no, but policies are planned, 7.35% answered no. Most of respondents agreed that the company has policies and available internally and publicly. Figure (4.19) below is shown the results.

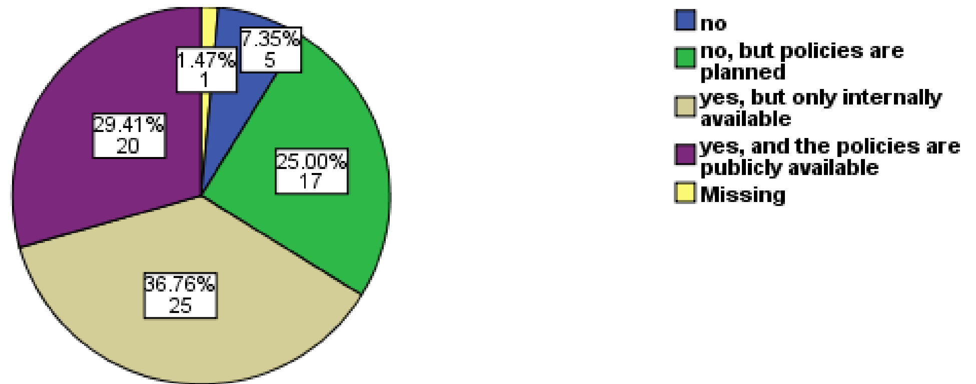


Figure (4.19)
Frequencies and percentages – SV10

SV11: Does the company have policies targeted rid of unwanted and inefficient junk from its various activities, such as delays, mistakes, defects, waste of all kinds, Accidents, Negligence ... etc.?

About 6% of respondents answered yes, and the policies are publicly available, 23.53% answered yes, but only internally available, 50% answered no, but policies are planned, 19.12% answered no. Most of respondents agreed that the company does not have policies targeted rid of unwanted and inefficient junk from its various activities at the planning level or in general. Figure (4.20) below is shown the results.

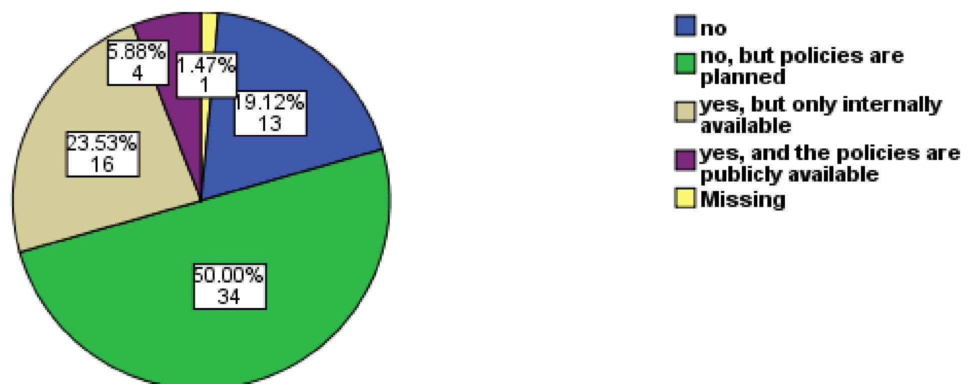


Figure (4.20)
Frequencies and percentages – SV11

SV12: Does the company have policies covering life cycle consideration?

About 53% of respondents answered yes, and the policies are publicly available, 20.6% answered yes, but only internally available, 8.8% answered no, but policies are planned, 10.3% answered no. Most of respondents agreed

that the company have policies covering life cycle consideration and available internally and publicly. Figure (4.21) below is shown the results.

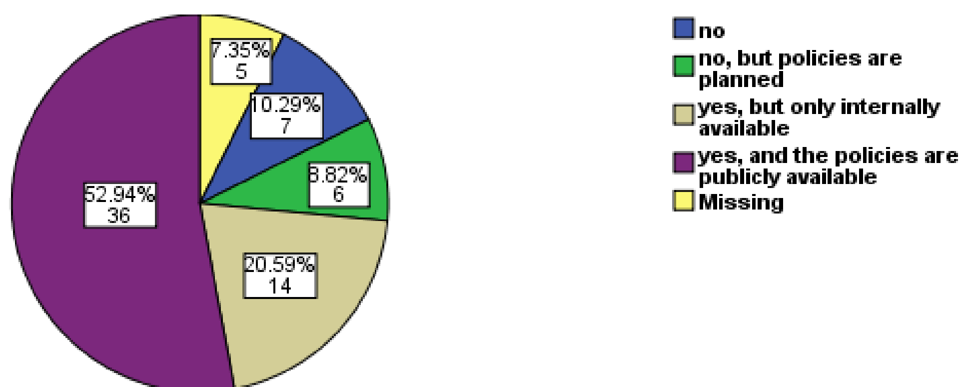


Figure (4.21)
Frequencies and percentages – SV12

4.3 Case Studies

It is necessary to take a look at the position of the company, such as financial indicators, the associates, contributions to the service of local communities, contributions to the protection of the environment and local communities, safety and risk management, through the annual reports of the companies.

4.3.1 Arab Potash Company Annual Report 2012

Fifty sixth annual report, including the summary of the company's business activities and achievements for the year ended 31 December 2012.

Trend of major financial indicators for the period 2008 – 2012

The following table summarizes the major indicators for the past five years. All figures (except for the financial ratios, production and sales volumes) are in Thousands of Jordan Dinars.

Table (4.2)
Trend of major financial indicators for the period 2008 – 2012

Details	2012	2011	2010	2009	2008
Potash Production (Million Tones)	1.8	2.3	1.9	1.1	2.0
Potash Sales (Million Tones)	1.6	2.2	2.1	0.9	1.9
Net Profit After Tax	198,800	299,700	162,700	131,800	311,400
Debt: Equity Ratio	0.8%	2.0%	3.9%	6.1%	8.6%

Investments in associates

This item represents gain (loss) from investments in associates as follows in table (4.3):

Table (4.3)
Investments in associates
(JD "000")

	2012	2011
Jordan Bromine Company (JBC)	12,782	19,360
Nippon Jordan Fertilizer Company (NJFC)	(164)	(575)
Jordan Investment and South Development Company (JISDC)	(20)	(20)
Jordan Industrial Port Company (JIPC)	(62)	(30)
Jordan International Chartering Company (JICC)	12	29
Jordan Safi Salt Company*	-	-
Total	**12,548**	**18,764**

* Under liquidation

APC contributions to the service of local communities

APC paid millions of JD to support development projects in education, health, water, fighting poverty, sports activities, religious affairs, and literary activities, as shown in figure (4.22).

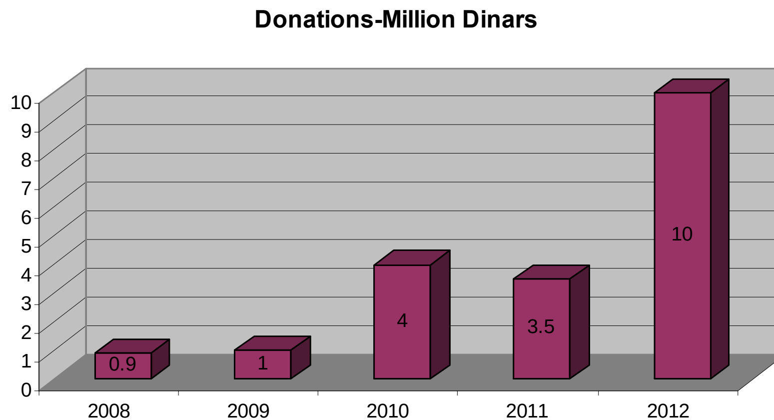


Figure (4.22)
APC contributions to the service of local communities

APC contributions to the protection of the environment and local communities

The company planned to minimize environmental damage, and preserve the environment and landscape. The company has received a certificate of conformity to global ISO 14001 in this regard.

Safety

APC considers that its top priority is to provide a safe work environment for its employees. In 2012, APC exceeded 4 million person hours without a lost time injury, as shown in figure (4.23).

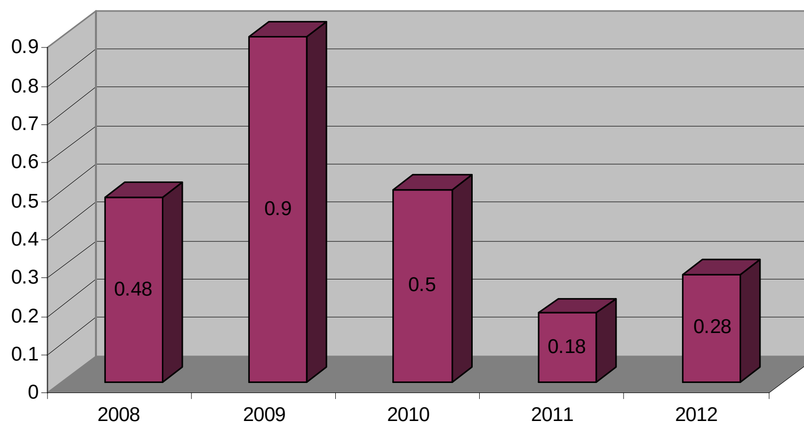


Figure (4.23)
APC annual accident frequency rate of injury per 200,000 person hours worked

Risk management

The nature of APC's activities exposes it to many factors beyond the Company's control.

1- Global markets and the slowdown in the global economy, resulting in decreased demand for potash.
2- Changes and amendments to laws and government regulations.
3- Rising energy costs and the scarcity of water.
4- The company depends entirely on the Aqaba port for loading and transportation of most of its potash production.
5- Labor disputes and the political situation.
6- Vulnerability to natural disasters.

4.3.2 Jordan Phosphate Mines Company Annual Report-2011

Fifty eighth annual report, including the summary of the company's business activities and achievements for the year ended 31 December 2011.

Trend of major financial indicators for the period 2007 – 2011

The following table summarizes the major indicators for years (2007-2011). All figures (except for the financial ratios, production and sales volumes) are in Thousands of Jordan Dinars.

Table (4.4)
Trend of major financial indicators for the period 2007 – 2011

Details	2011	2010	2009	2008	2007
Phosphate Production (Million Tones)	7.594	6.529	5.281	6.265	5.552
Phosphate Sales (Million Tones)	7.441	6.506	5.191	5.924	5.625
Net Profit for (PH*). And ASS. CO.** After Tax	145,255	80,232	92,878	238,622	46,110
Debt: Equity Ratio	7:93	5:95	4:96	7:93	19:81

* PH: Phosphate
** ASS. CO.: Associates Companies

Investments in associates

This item represents gain (loss) from investments in associates as follows in table (4.5):

Table (4.5)
Investments in associates

	2011	2010
	JD “000”	JD “000”
Group's share	21,624	11,336
(Loss) Gain on revaluation of associates	(4,291)	9,299
	17,333	**20,635**

JPMC contributions to the service of local communities

JPMC paid millions of JD to support development projects in education, health, water, fighting poverty, sports activities, religious affairs, and literary activities, as shown in figure (4.24).

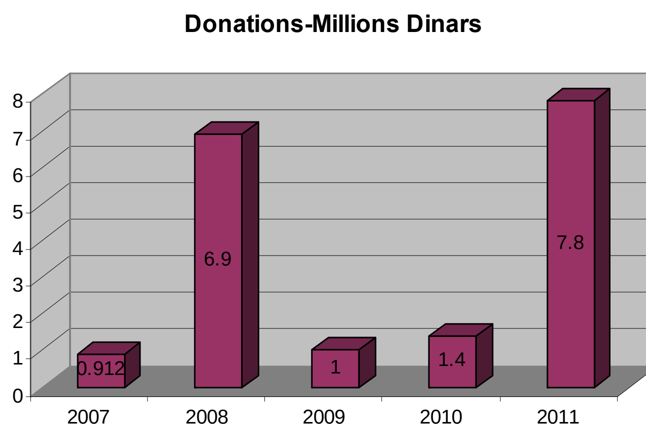


Figure (4.24)
JPMC contributions to the service of local communities

JPMC contributions to the protection of the environment and local communities

JPMC has received a certificate of International Standard (ISO1401:2004) and Quality Management System (ISO9001:2008) granted from (Lloyd's Register Quality Assurance), also signed an agreement with the Royal Scientific Society to measure the concentrations of dust.

Safety

JPMC has a certificate of Safety and Occupational Health (OHSAS 18001:2007).

Risk management

Company suffers from high fuel prices and the prices of some raw materials (ammonia, sulfur and aluminum hydroxide) within the fertilizer industry, which leads to high operating costs of the company and the company faces competition in the marketing of its products in some international markets as a result of rising production costs.

Note from the above, the annual reports correspond to the current study in terms of the agreement most of the respondents that the company has policies that support the community and the environment and occupational health and safety, but the reports indicate the presence of undesirable (junk) activities, such as:

1- Losses and liquidation in the associates.
2- Long/short Term Loans and Other Long Term Obligations.
3- Contingencies commitments and Legal claims (APC annual report, 2012, pg. 76), (JPMC annual report, 2011, pg. 97).
4- Risks and challenges.
5- Depending on the report, the companies are not a member of the UN Global Compact, and this does not guarantee implementation and preserve the gains of sustainable value, and the report shows that there is no policy against administrative and financial corruption within the companies.

4.4 Discussion of the Results

Based on the results of the first variable (awareness of value engineering), very few of the respondents know the essence of value engineering, and this obvious through the inaccurate perceptions and a lack of knowledge that has appeared through answering the third question which tests the accuracy of respondents' answers where the percentage was not exceeds 1.5%. But it is noted that there is a high percentage of the respondents have a desire to learn more about value engineering (88.1%).

Depending on the results of the second variable (practice of value engineering), it can be noted the following: respondents views vary in terms of the use of value engineering, number of exercises is very low, inaccurate perceptions when asking about value engineering as compared with other cost control techniques and significant proportion has no desire to pay the cost of any study provided by value engineering thus, it can be concluded that the employees do not have the required competence for the application of value

engineering, so there is no actual usage in their organisation and still there is a confusion about the use of value engineering and fear that the application of value engineering is expensive. Without overlook the important points which have cited by some employees, such as care provided by the central administration to the staff of central administration is more than the rest of employees in branches.

By analyzing the results of the third variable (sustainable value), we can see that most of respondents of engineers and managers are not involved in the strategic plans for sustainable value creation in the company, and this is illustrated through varying views of respondents. In addition most of them are not familiar in the UN (United Nations) global compact, it seems to be a personal responsibility rather than a company's responsibility. It can be noted by the results that most respondents agree that there are policies offered by the company covers the following areas: human and labour rights, environmental protection, responsible business conduct, and health, working environment and safety. About (34%) of respondents had a different view about the anti-corruption policy, they denied that the company has a policy to fight corruption which reveals a side of dissatisfaction of those respondents. This necessarily will reflect on their performance and will allow corruption to spread in the company and then impact on the administrative and financial situation of the company until liquidation of the company in many of cases.

A high proportion of respondents (71%) sees a problem in the company deal with the consumption of resources and this may lead to resource depletion on the near or medium term, A high proportion of respondents (69%) sees a problem in the company deal with the junk activities such as delays, mistakes, defects, waste of all kinds, Accidents, Negligence ... etc. This in turn will have a negative impact on the company's activities in general.

A significant proportion (46%) sees that the company's role is not enough to create a balance between the environment, economy and society, this is not inconsistent with the answers to previous question when the respondents were asked about the environment protection, according to the analysis of the current study to this point the respondents believe that the support for "environment protection" and "society" is not commensurate with the profit and the company's income and the support still not enough to make the balance between the environment , society and economic This decline in the adoption of this concept will lead at the end to company failure to adopt a global concept that has a very important role in creating sustainable value.

(32%) of respondents are not satisfied with the evaluation method adopted by the company in the evaluation of the current and future situation through the lack of a clear methodology followed by the company and this could lead

to confrontation with many of the obstacles and the inability to deal with variables and surprises of the markets.

There are still many of the respondents in spite of the low percentage are dissatisfied in company efforts for the rest of the principles of sustainability, such as human and labour rights, responsible business conduct, health, working environment and safety and the company must look at the reasons for its importance in job satisfaction and performance and for stay away from Labor disputes.

4.5 Summary of the Results

Table (4.6) shows a summary of the results that have been obtained by the current study which contains the following:

1- Value engineering position according to the current study.
2- Sustainable value principles and its implementation in the companies selected by the current study.
3- Some of the results and problems faced by the targeted companies in the current study as a result of not applying the concept of value engineering.

Table (4.6)
Summary of the results

Value engineering position according to the current study	
Awareness	**Practice**
Very few of the respondents know the essence of value engineering.	There is no actual usage.
Sustainable value principles and its implementation in the companies selected by the current study	
Most of respondents of engineers and managers are not involved in the strategic plans for sustainable value creation in the company and most of them are not familiar in the UN (United Nations) global compact. The principles of sustainable value and the percentage of respondents who have denied the company application of these principles illustrated in figure (4.25).	

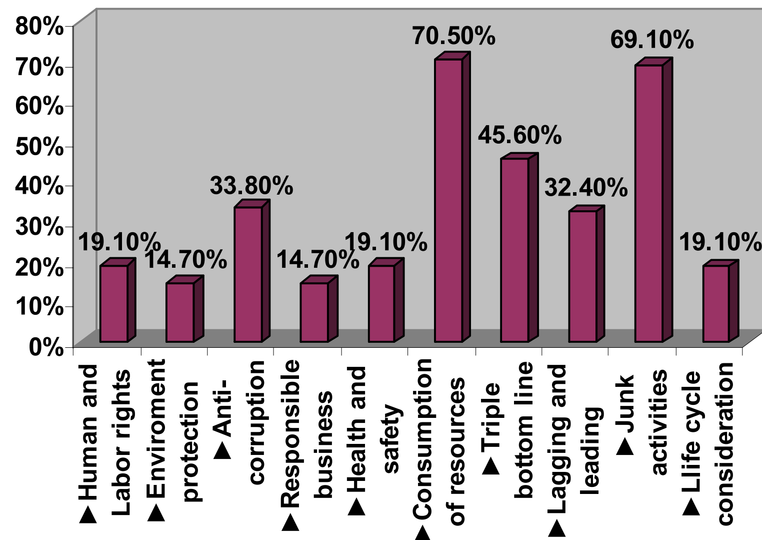


Figure (4.25)
Views of respondents about the principles of sustainability

Some of the results and problems faced by the targeted companies in the current study as a result of not applying the concept of value engineering	
Through the annual reports	Through the current study
1- Decreased demand for product. 2- Rising energy costs and the scarcity of water. 3- Depending entirely on one port. 4- Labor disputes. 5- Competition in the marketing. 6- Losses and liquidation in the associates. 7- Long/short term loans and other long term obligations. 8- Contingencies commitments and legal claims.	Depending on the figure (4.25) several important points can be concluded: 1- A high proportion of respondents (71%) sees a problem in the company deal with the consumption of resources and this may lead to resource depletion on the near or medium term. 2- A high proportion of respondents (69%) sees a problem in the company deal with the junk activities such as delays, mistakes, defects, waste of all kinds, Accidents, Negligence ... etc. This in turn will have an negative impact on the company's activities in general. 3- A significant proportion (46%) sees that the company's role is not enough to create a balance between the environment, economy and society. This decline in the adoption of this concept will lead to

Table (4.6) continued…

	company failure to adopt a global concept that has a very important role in creating sustainable value. 4- (34%) of respondents denied that the company has a policy to fight corruption which reveals a side of dissatisfaction of those respondents. This necessarily will reflect on their performance and will allow corruption to spread in the company and then impact on the administrative and financial situation of the company until perhaps up to liquidation. 5- (32%) of respondents are not satisfied with the evaluation method adopted by the company in the evaluation of the current and future situation through the lack of a clear methodology followed by the company and this could lead to confrontation with many of the obstacles and the inability to deal with variables and surprises of the markets. 6- There are still many of respondents in spite of the low percentage are dissatisfied in company efforts for the rest of the principles of sustainability, and the company must look at the reasons for its importance in job satisfaction and performance and for stay away from Labor disputes.

Therefore, according to the current study, we can see the importance of use value engineering to get the junk out of corporate activities, manages and reduces risks, achieves best value and reduces costs, increases profitability and other competitive advantages, and all of that creates sustainable value.

4.6 Conclusions, Limitations and Recommendations

The aim of this study is to assess the awareness of value engineering and to investigate value engineering (VE) practice in (JPMC and APC) as cases of

study, and to investigate the sustainable value principles and its implementation in both companies, and the importance of the use and adoption of value engineering to achieve sustainable value in the Jordanian industry sector to reach sustainable industry, In addition measure the willingness to learn more about value engineering. The survey explores engineers' and managers' familiarity with and understanding of value methodology and extent of the use of VE within their organizations and examines the awareness in "the culture of sustainability" and its implementation in the targeted organizations. To achieve the purpose of the study, descriptive analysis was performed. Data was collected by questionnaire survey. A total of 100 managers and engineers representing the research sample were approached for data collection.

4.6.1 Conclusions

1- The findings indicate that very few of respondents in Jordan Phosphate Mines Company and Arab Potash Company know the essence of value engineering and there is no actual usage in their organisation. This is consistent with the findings of prior studies (e.g., Bowen, Jay and Cattell, 2010; Bowen, Jay and Cattell, 2011; Fong, 1998). And a high percentage of the respondents have a desire to learn more about value engineering. This is consistent with the findings of (Fong, 1998).
2- The findings indicate that although the concept of sustainability is well understood within the most of respondents of engineers and managers, but most of them are not involved in the strategic plans for sustainable value creation in the company and company procedure towards sustainable value creation is not enough until now, suffers from a lack of transparency, a lack of familiarity or involvement of the workforce in the strategic plans of creating sustainable value in the company, imbalance in the application of a number of the principles of sustainability and the absence of reference to ensure and monitor the application of the principles of sustainability such as UN global compact.
3- This study provides insight for achieving sustainable value through value engineering. Through value engineering a company manages and reduces risks, achieves best value and reduces costs, increases profitability, other competitive advantages and get the junk out of corporate activities. "Further, any potential or actual social or economic harm to internal or external individuals, groups or communities arising from corporate activities is wasteful. Here's why. It requires diversion

of scarce corporate resources to manage unnecessary risks" (Borges, 2012). All these elements can be managed and controlled by VE.

4- The concept of sustainable industries is not new it was hatched in Portland in the summer of 2002 by business journalist Brian Back and Nik Blosser, president of Celilo Group Media (Sustainable Industries). Judging from the findings of this study and literature (Borges, 2012; El-Alfy, 2010; Al-Saleh and Taleb, 2010; Zainul Abidin and Pasquire, 2005), if we adopt VE methodology sure we will reach and achieve sustainability in business, industry and every side in our life (e.g. green building, clean energy, technology, food, farms, green marketing, business leaders, finance, transportation, education… etc.).
5- It is an invitation for use and adopt of value engineering in all sectors, especially in industry sector and achieve sustainability through the apparent integration that we see between the use of value engineering and getting sustainable value, which do not conflict with profitability as many believe, this integration when done right, enables a progressive for-profit company to as Borges, (2012) says: Make money by doing good!

4.6.2 Limitations and Recommendations of the Study

The limitations and implications of this study provide further ways for future research. The following represents the main limitations and recommendations for future research:

1- The current study has focused on sustainable value perspective through value engineering concept, this may encourage future studies to explore this topic due to a lack of research and development in each of the concepts.
2- This study examined value engineering (VE) awareness and practice in Jordan Phosphate Mines Company and Arab Potash Company within Jordanian industry sector. Future studies can examine other sectors such as property and construction industry, transportation, energy, education... etc.
3- This study utilized a single method for data collection (questionnaire) to test the variables of the study. Using multiple data collection methods would provide more understanding, such as interviews.
4- The sample of the study was composed of only engineers and managers in Jordan Phosphate Mines Company and Arab Potash Company within Jordanian industry sector. The researcher could not obtain a comprehensive sampling frame to draw a representative random sample. Thus, the findings of the study are applicable only to the

responding engineers and managers in both companies and can not be generalized to the whole population in Jordanian industry sector. Thus, future studies can use more representative and larger sample would be beneficial to check whether the findings can be generalized to the population.

5- The current study recommends the future studies to write in the same topic but use other variables, such as profitable environmental management through value engineering and value engineering for hazardous waste projects, because there is a lack in covering these areas or topics in Jordan generally, and in industry sector especially.
6- Some employees appeared in a state of hesitation and non-cooperation , fearing for their positions (as one of them told me) and this is because they have read the question that is talking about corruption within the company and some of them showed indifference, therefore the current study recommends focusing on the following important things related to staff: the psychological state of the employee, employee job satisfaction, training and rehabilitation, work in horizontal organizational structure, the new ideas and creative.
7- The current study also raises additional recommendations which enhance the awareness in importance of value engineering in Jordan industry sector, which is represented through action by academic institutions and professional organizations to provide the greater awareness and training to the industry professionals on the use and adoption of VE and make value engineering a mandatory requirement in the projects, as the case in kingdom of Saudi Arabia, which is mandatory in all ministries, institutions and government bodies (Ministry of Finance, 2001).
8- Value Engineering!!! The term seemed amazingly for some of respondents, therefore the current study recommends that the industrial sector should give a special interest to this issue and other important topics that fall under the umbrella of the specialty "Engineering Management".

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Appendix I
English Questionnaire



Mu'tah University

Manufacturing Industry Survey

Dear Sirs,

We are undertaking a survey of the position of value engineering in Jordanian industry sector, and its importance in value creation and sustainable development, which is a requirement for long-term value creation and future financial returns. Value creation is sustainable when managing the balance between society, environment and economy.

Value Engineering is: A powerful tool that is used to identify problems and develop proposed solutions by determines the best design alternatives projects, processes, products or services. It is used to reduce unnecessary cost, improve quality, increase reliability, availability, and customer satisfaction. In other meaning it is used to improve organizational performance.

This study is undertaken as a partial fulfillment for the requirement of master of Engineering Management (MEM) - program for the researcher.

This questionnaire is focused on areas and issues we think are crucial for you especially and for Jordanian industry sector generally, so taking into consideration your participation is critical for the success of this study.

We also ensure the confidentiality of all information received and will be used solely for scientific research purposes.

Finally, we would like to thank you for your cooperation. We should be most grateful if you could complete this questionnaire, and a copy of the study results will be furnished to you upon your request.

Yours sincerely

Supervisor
Prof. Dr. Saloom Al-Jibury
Mu'tah University
Industrial Systems Engineering Department

Researcher
Mohamd Omar Al-Laimon
Mu'tah University
Industrial Systems Engineering Department

SECTION A: DEMOGRAPHIC INFORMATION

A1: Educational Level: ☐ Diploma ☐ Bachelors
☐ Master ☐ PhD

A2: Number years of experience in current job.

Less than 3 year	☐	☐	3-6 year
7-10 year	☐	☐	More than 10 year

A3: Membership of a professional value engineering institution. (Please select all that apply)

☐ IVM (The Institute of Value Management)
☐ SAVE International (Society of American Value Engineers)
☐ None
☐ Other (Please cite)……………………………………………………........

A4: Job title: ………………………...

SECTION B: AWARENESS OF VALUE ENGINEERING

B1: Have you ever heard of the terms value engineering, value analysis or value management before receiving the questionnaire?
 Yes (clear understanding).
 Yes (not clear about it until I read the given definition).
 No

- If your answer to Question B1 is "Yes", please answer the questions (2,3).

B2: Where did you first hear about value engineering?
 Professional Institution
 Within my company
 From an academic establishment or from a course that I attended
 Via an industry newsletter or via online media such as the internet
 Other (please cite):

B3: Value engineering is another name for a cost-saving exercise, or a quality control.
 Yes
 No

B4: Are you interested in learning more about value engineering and its application?
 Yes
 No

SECTION C: PRACTICE OF VALUE ENGINEERING

C1: Is Value engineering used in your current organization?
 Yes Not sure
 No Only in some aspects

- If your answer to Question C1 is "Yes", or "Only in some aspects" please answer the questions (2,3,4).

C2: How many value engineering exercises have you been involved in (approximately)?

☐ 1-3
☐ 4-6
☐ 7 or more
☐ None

C3: What are the most important factors that prevent the use of value engineering in your job or company?

☐ Time
☐ Cost
☐ Administrative legislations
☐ Other (please cite):

C4: What is your perception of value engineering as compared with other cost control techniques?

☐ Value engineering is a good way of achieving "value for money"
☐ Value engineering is the same as other cost control techniques
☐ Other (please cite):

C5: Are you willing to pay the cost of any study provided by value engineering?

☐ Yes
☐ No

SECTION D: SUSTAINABLE VALUE CREATION

D1: Does the company have strategic plans for sustainable value creation?
A value creation is sustainable when managing the balance between society, the environment and economy.

□ Continuously □ Yearly
□ Now and then □ Rarely
□ Never

D2: Is the company a member of the UN Global Compact?
The UN Global Compact is a framework for businesses that are committed to aligning their operations and strategies in the areas of human rights, labour rights, the environment and anti-corruption

□ Yes □ No
□ Planning to become a member □ Not familiar with the Global Compact

No.	Item	No	No, but policies are planned	Yes, but only internally available	Yes, and the policies are publicly available
3	**Does the company have policies covering human and labour rights?**				
4	**Does the company have policies covering environmental protection?**				
5	**Does the company have policies covering anti-corruption?**				
6	**Does the company have policies covering responsible business conduct*?**				
7	**Does the company have policies covering health, working environment and safety?**				
8	**Does the company have policies that seek to reduce the consumption of resources?**				
9	**Does the company have policies that seek to find a balance between economic, environmental, and societal performance?**				
10	**Does the company have policies to monitor their progress toward achieving their goals for example, use (lagging indicators) to measure the results or outcomes and (leading indicators) to measure internal practices or efforts that are expected to improve future performance?**				

11	**Does the company have policies targeted rid of unwanted and inefficient junk from its various activities, such as delays, mistakes, defects, waste of all kinds, Accidents, Negligence ... etc.?**				
12	**Does the company have policies covering life cycle consideration?**				

* Responsible business conduct covers the following areas: taxes, protect the interests of the customers and consumers, competition, research and development…

Thank you for your cooperation. Your time and effort is appreciated. If you would like a copy of the results, please provide your email address in the space provided.
Your email address:

Appendix II
Arabic Questionnaire



جامعـــة مؤتـــة

استبانـــة

السادة الكرام:

نقوم بعمل مسح ميداني نقيم من خلاله وضع هندسة القيمة في القطاع الصناعي الاردني و اهميتها في خلق القيمة والتنمية المستدامة والتي هي من شروط خلق القيمة طويلة الأجل وتحقيق وفورات وعائدات مالية في المستقبل. خلق القيمة المستدامة يعني إدارة التوازن بين البيئة والمجتمع والاقتصاد.

هندسة القيمة هي أداة فعالة تستخدم لتحديد المشاكل ووضع الحلول المقترحة عن طريق اختيار أفضل بدائل تصميم المشاريع، العمليات،المنتجات أو الخدمات. يتم استخدامها لتقليل التكاليف غير الضرورية وتحسين الجودة وزيادة الموثوقية والوفرة وتحقيق رضا العملاء. بمعنى آخر تستخدم لتحسين وتطوير الأداء التنظيمي.

تركز هذه الاستبانة على مجالات وقضايا نعتقد أنها مهمة وحاسمة بالنسبة لكم خاصة وللقطاع الصناعي الأردني بشكل عام، لذلك يرجى الاخذ في الاعتبار ان مشاركتكم هامة لنجاح هذه الدراسة، مؤكدين لكم أن جميع المعلومات سوف تعامل بسرية تامة وتستخدم لأغراض البحث العلمي فقط.

تجري هذه الدراسة استكمالاً لمتطلبات الحصول على درجة الماجستير في الإدارة الهندسية (MEM). وأخيرا، نود أن نشكركم على تعاونكم. ونحن في غاية الامتنان لو أمكنكم إكمال هذا الاستبانة، وسوف نقدم لكم نسخة من نتائج الدراسة بناءاً على طلبكم.

شاكرين لكم حسن تعاونكم

المشرف:
ا.د سلوم الجبوري
جامعة مؤتة\كلية الهندسة

الباحث:
محمد عمر الليمون
جامعة مؤتة\ كلية الهندسة

الجزء الأول : البيانات الديموغرافية

أرجو تعبئة البيانات التالية :

1- المستوى التعليمي: دبلوم ☐ بكالوريوس ☐ ماجستير ☐ دكتوراه. ☐

2- عدد سنوات الخبرة في الوظيفة الحالية:

اقل من 3 سنوات ☐ 3-6 سنوات ☐

7-10 سنوات ☐ أكثر من 10 سنوات ☐

3- هل الشركة عضو في احدى المعاهد المختصة بهندسة القيمة

☐ معهد ادارة القيمة (IVM)

☐ جمعية مهندسي القيمة الامريكيين (SAVE International)

☐ لا يوجد

☐ اخرى...

المسمى الوظيفي:..

الجزء الثاني : الوعي بهندسة القيمة

1- هل سمعت من قبل بمصطلح "هندسة القيمة" او "تحليل القيمة" او "ادارة القيمة" قبل استلام هذه الاستبانة؟

☐ نعم (فهم واضح)

☐ نعم (فهم غير واضح لغاية قراءات التعريف الوارد في الاستبانة)

☐ لا

في حال الاجابة بالإيجاب على السؤال رقم (1) الرجاء الاجابة عن الاسئلة (2,3)

2- من اين سمعت عن هندسة القيمة؟

☐ معهد او مؤسسة مهنية

☐ من خلال الشركة التي اعمل بها

☐ من خلال مؤسسة اكاديمية او مساق دراسي

☐ من خلال مجلة صناعية او وسائل الاعلام مباشرة كالانترنت

☐ اخرى..

3- هندسة القيمة هي مسمى اخر لممارسة توفير التكاليف او لمراقبة الجودة

☐ نعم

☐ لا

4- هل أنت مهتم بمعرفة المزيد عن هندسة القيمة وتطبيقاتها؟

☐ نعم

☐ لا

الجزء الثالث: ممارسة هندسة القيمة

1- هل تستخدم هندسة القيمة في الشركة؟

☐ نعم ☐ لست متأكداً

☐ لا ☐ في بعض الجوانب فقط

- في حال الاجابة بالإيجاب على السؤال رقم (1) الرجاء الاجابة عن الاسئلة (2,3,4)

2- كم عدد الدورات التدريبية في هندسة القيمة التي شاركت بها (تقريباً)؟

☐ 1-3

☐ 4-6

☐ 7 او اكثر

☐ لا يوجد

3- ماهي اهم العوامل التي تحد من استخدام هندسة القيمة في عملك او شركتك ؟

☐ الوقت

☐ التكلفة

☐ التشريعات الادارية

☐ اخرى...

4- ما هو تصورك عن هندسة القيمة بالمقارنة مع غيرها من تقنيات التحكم في التكلفة؟

☐ هندسة القيمة هي وسيلة جيدة لتحقيق "القيمة مقابل المال"

☐ هندسة القيمة لا تختلف عن غيرها من تقنيات التحكم في التكلفة

☐ اخرى...

5- هل أنت على استعداد لدفع تكاليف أي دراسة تقدمها هندسة القيمة؟

☐ نعم

☐ لا

الجزء الرابع: خلق القيمة المستدامة

1- هل لدى الشركة خطط استراتيجية لخلق قيمة مستدامة في الشركة؟

* خلق القيمة يعتبر مستدام عند ادارة التوازن بين المجتمع والبيئة والاقتصاد

☐ مستمر ☐ سنوي

☐ احياناً ☐ نادراً

☐ لايوجد

2- هل الشركة عضو في ميثاق الامم المتحدة العالمي (UN Global Compact)؟

* ميثاق الامم المتحدة العالمي هو اطار للاعمال التجارية التي تتعهد بترتيب العمليات والاستراتيجيات الخاصة بهم ضمن اطر حقوق الانسان، حقوق العمال، البيئة ومكافحة الفساد

☐ نعم ☐ لا

☐ تخطط للحصول على العضوية ☐ الميثاق ليس مألوف لنا

الرقم	الفقرة	نعم، السياسات متوفرة للعموم	نعم، لكن السياسات متوفرة داخلياً	لا، لكن السياسات يخطط لها	لا
3	**هل لدى الشركة سياسات تعنى بحقوق الانسان والعمال؟**				
4	**هل لدى الشركة سياسات تعنى بحماية البيئة؟**				
5	**هل لدى الشركة سياسات تعنى بمكافحة الفساد؟**				
6	**هل لدى الشركة سياسات تعنى بمسؤلية تسيير الاعمال*؟**				
7	**هل لدى الشركة سياسات تعنى بالصحة وبيئة العمل والآمان؟**				
8	**هل لدى الشركة سياسات تسعى للحد من استهلاك الموارد؟**				
9	**هل لدى الشركة سياسات تسعى إلى إيجاد توازن بين الأداء الاقتصادي والبيئي والمجتمعي؟**				
10	**هل لدى الشركة سياسات لرصد التقدم المحرز تجاه تحقيق أهدافها على سبيل المثال استخدام (مؤشرات لاحقة للحدث) لقياس النتائج أو المخرجات و(مؤشرات موجهه) لقياس الممارسات الداخلية أو الجهود التي من المتوقع أن تحسن الأداء في المستقبل؟**				
11	**هل لدى الشركة سياسات تستهدف التخلص من الاشياء او الامور الغير مرغوب فيها و الغير فعالة من أنشطتها المختلفة مثل التأخير،،الأخطاء ، العيوب، النفايات بجميع أنواعها، الحوادث، والإهمال ... وما إلى ذلك؟**				
12	**هل لدى الشركة سياسات تعنى بدورة حياة المنتج والممتلكات؟**				

* مسؤلية تسيير الاعمال تغطي المجالات التالية: الضرائب، حماية مصالح الزبون والمستهلك، المنافسة، البحث والتطوير

مرة اخرى نشكر لكم تعاونكم. وقتكم وجهودكم مقدرة. في حالة الرغبة في الحصول على نسخة من النتائج نرجو تزويدنا بالبريد الالكتروني

Appendix III
Judiciary Group

No.	Name	Place	Position
1	Dr. Samer Al-Bashabsheh	Mu'tah University – Jordan	Deputy Dean of Business Administration Faculty
2	Dr. Yassen Al-Tarawneh	Arab Open University – Saudi Arabia	Dean of Economics Faculty
3	Dr. Falah Al-Sarayrah	Mu'tah University – Jordan	Assistant Professor-Engineering Faculty
4	Dr. Maan Mashagbah	Almafrag-Jordan	Doctor of Business Administration-Statistical Analyst
5	Phosphate staff	Al-Hassa mine	-
6	Potash staff	Plant	-

Appendix IV
Survey Sample

Survey Sample			
Ref.	**Company**	**Firm address**	**Tel.**
1	Arab Potash	1470, Amman - 11118 Jordan	+ 962 6 5200520
2	Jordan Phosphate Mines (center)	Amman – Jordan	+962 6 560 7141
3	Al-Hassa mine (Phosphate/plant)	Al-Tafila, 130 km south of Amman	+962 6 560 7141
4	Al-Abiad mine (Phosphate/plant)	Al-karak, 110 km south of Amman	+962 6 560 7141

Appendix V
Glossary

Glossary	
Function Analysis System Technique	Classical FAST Model: A function displaying interrelationship of functions to each other in "how-why" logic that was developed by Charles. (SAVE, 2007).
Function Analysis	The process of defining, classifying and evaluating functions. (SAVE, 2007, pg. 28-31).
Value Engineering Job Plan	A sequential approach for conducting a value study, consisting of steps or phases used to manage the focus of a team's thinking so that they innovate collectively rather than as uncoordinated individuals. (SAVE, 2007, pg. 28-31).
Total Quality Management	is a management philosophy that seeks to integrate all organizational functions (marketing, finance, design, engineering, and production, customer service, etc.) to focus on meeting customer needs and organizational objectives. (Tewari and Dias, 2010, pg. 36).
Quality Function Deployment	Is a method for developing a design quality aimed at satisfying the consumer and then translating the consumer's demand into design targets and major quality assurance points to be used throughout the production phase. (Akao, 1990).
Concurrent Engineering	Is an engineering management philosophy and a set of operating principles that guide a product development process through an accelerated successful completion. (Yassine and Braha, 2003, pg. 165).
Reengineering	Is a fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed. (Hindle, 2008).

Benchmarking	Is a management tool gives an opportunity to critically analyze value chains (a string of companies or players working together to satisfy market demands for a special product). (Jochem and Landgraf, 2008).
Value analysis	The application of value methodology to an existing project, product or service to achieve value improvement. (SAVE, 2007).
Value management	The application of value methodology by an organization to achieve strategic value improvement. (SAVE, 2007, pg. 28-38).
Value engineering	The application of value methodology to a planned or conceptual project or service to achieve value improvement. (SAVE, 2007).
UN Global Compact	The UN Global Compact is a framework for businesses that are committed to aligning their operations and strategies in the areas of human rights, labour rights, the environment and anti-corruption (The Sustainable Value Creation Initiative Questionnaire, 2009).

المعلومات الشخصية

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